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General Surgery

Application of the Roux en Y Anastomosis to Diseases of the Pancreas

A. H. LETTON, M.D., F.A.C.S., F.I.C.S.

AND

JOHN PAGE WILSON, M.D., F.A.C.S.

ATLANTA, GEORGIA

THE en Y anastomosis has found many and varied uses in the past sixty years. This anastomosis, which usually bears Roux's name, was attributed by Roux to Socin, while the latter credited it to Wölfler.[1]

The anastomosis consists of producing a Y type of configuration with a piece of bowel by transecting it, and then restoring continuity at a lower level with a proximal end-to-distal-side anastomosis. This produces one limb that is "defunctionalized." Pierce[2] has shown that the optimum length for "defunctionalizing" that limb is 12 inches (30 cm.), for this length prevents regurgitation.

This configuration was first used in gastrojejunostomy, to prevent the "vicious cycle" that was a major complication of gastroenterostomy. It prevented this well, but was complicated too often by peptic ulceration owing to the dumping of acid chyme onto the jejunal mucosa without first being neutralized by the duodenal contents. Mann and Williamson have utilized this configuration to produce peptic ulcers in the dog for experimental purposes. Because of the ulcer complications, this use of the Roux en Y anastomosis has

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been abandoned; its use when a defunctionalized limb of bowel is needed, however, remains a valuable aid to the surgeon.

Several pathologic conditions of the pancreas seem to respond satisfactorily when this type of anastomosis is utilized. A discussion of these conditions, including the etiologic factors in each classification and the reasons why the Roux en Y configuration lends itself well to this treatment, follows.

Chronic Pancreatitis—Since Opie,[3] in 1901, first described a stone obstructing the ampulla of Vater, causing regurgitation of bile through the common channel between the common bile duct and the pancreatic ducts, this has been recognized as one of the causes of pancreatitis. Archibald,[4] in 1919, introduced the theory that spasm of the sphincter of Oddi could also cause regurgitation through the common channel. Certainly, hypertrophy of the ampulla of Vater and a tumor of that area could cause this same condition. Various methods of relieving this type of obstruction have been suggested. Chronic, relapsing pancreatitis is a severe, disabling disease. It has been said that 10 to 15 per cent of the patients with chronic relapsing pancreatitis commit suicide.[5]

Removal of the offending stone or tumor should prevent further entrance of bile into the pancreatic system and suffices in most uncomplicated cases. In our experience sphincterotomy has been successful when cicatrix, spasm or hypertrophy of the sphincter of Oddi has been the pathologic variant.

Choledochojejunostomy, which consists of transecting the common duct and placing it into the defunctionalized end of the jejunum en Y, has proved valuable in some instances.[6] By this procedure all the bile is deflected from the pancreas, and further pancreatitis from this cause is thus prevented. There are certain patients who are not relieved by this procedure.[7] Recently, we operated on a patient with relapsing pancreatitis who could not have been benefited by choledochojejunostomy, for we were able to demonstrate that the duct of Wirsung entered the duodenum 1 cm. below and separate from the ampulla of Vater. An operative pancreatogram showed no connection between the biliary and the pancreatic system. It may well be that the underlying pathologic condition in some cases is obstruction of the duct due to metaplasia of the epithelium of the ducts, as described by Rich.[8] These also are patients in whom pancreatitis may have developed originally because of bile regurgitation; yet the scar tissue resulting from this inflammation is now causing obstruction to the pancreatic ducts. Floyd and Christopherson[9] have shown that partial or slowly increasing obstruction of the ducts seems to be a factor in the causation of relapsing pancreatitis. It is obvious that some procedure other than choledochojejunostomy is necessary in some cases. DuVal[10] has reported a series in which he used caudal drainage with the Roux en Y anastomosis. He established a rather rigid set of criteria to differentiate incomplete obstruction of the pancreatic duct from a defect of the biliary tree as the causative factor, and pointed out that this procedure should be used only when the duct is obstructed. When no ductal obstruction exists and one cannot find a simple obstruction at the ampulla of Vater, choledochojejunostomy probably should be done.

The single most helpful diagnostic device, in our experience, is the operative pancreatogram. To obtain this, the duodenum is opened longitudinally for about 4 cm. over the ampulla of Vater; a sphincterotomy (usually) is done, and then the pancreatic duct can be visualized lying just inside the inferior medial margin. Observation of a small gush of pancreatic fluid sometimes gives a clue to the location of the opening. A fine polyethylene tube is

inserted 4 to 5 cm. into the duct, and 10 cc. of undiluted Diodrast is injected. The roentgenogram is taken while the last 2 cc. is being injected. Any obstruction or dilatation of the pancreatic duct can be seen on the roentgen plate. If it is impossible to locate the opening of the duct of Wirsung or to insert the polyethylene tube because of obstruction, a needle fastened to the end of a piece of polyethylene tubing may be inserted into the dilated duct, which can be palpated in the body or tail of the pancreas. If no dilated duct can be located, then the procedure must be reconsidered. If one strongly suspects obstruction of the duct because of the lumpy, fibrotic pancreas, or because of pancreatic lithiasis as noted on the roentgen plate, the tail of the pancreas should be dissected up and transected. The main duct can then be visualized and catheterized, after which Diodrast can be injected and the roentgenograms taken.

When obstruction of the duct is demonstrated, DuVal's caudal amputation and pancreaticojejunostomy within the en Y anastomosis has given us consistently good results. Reynolds[11] and Banta[12] had opportunity to demonstrate that such an anastomosis remained patent.

No patient in whom the pancreatogram revealed the "chain of lakes" configuration described by Peustow,[13] has been encountered. We have not had opportunity, therefore, to utilize his modification of the caudal pancreaticojejunostomy for patients with multiple areas of stenosis of the pancreatic ducts.

Fistulas.—Pancreatic fistulas may develop from various causes, including injury to the pancreas during operation, after drainage of the pancreas or after marsupialization of a pseudocyst. The fistula is prone to persist for a long time, which in itself is rather annoying, and, combined with the excoriation of the skin by the pancreatic enzyme, it becomes all but intolerable. At times the fistula will close spontaneously, but if it persists it should be treated surgically. Culler[14] has reported 2 cases of fistula that he considers cured as a result of roentgen therapy. Connolly[15] has pointed out how persistent these fistulas can be, with their superficial healing and their secondary breakdown. Morbidity connected with external drainage can be measured in days when the fistulous tract is dissected out and fitted into the defunctionalized loop of the jejunum en Y. In each instance in which this approach has been used, we have obtained primary healing without recurrence of the fistula.

Pseudocysts. — Acute pancreatitis or trauma may cause breakdown of a varying number of acini, and when the intraductal pressure, which is the reflection of the tone of the sphincter of Oddi, is high enough there will be an extravasation of pan-

The employment of the Roux en Y anastomosis in the treatment of various diseases of the pancreas is discussed. This type of anastomosis is a very satisfactory method of (a) completely shunting all bile away from the pancreatic system by choledochojejunostomy; (b) curing pancreatic fistulas by implanting them into the defunctionalized limb; (c) curing pancreatic pseudocyst by cystojejunostomy; (d) treating relapsing pancreatitis due to obstruction of the pancreatic duct by caudal drainage through the anastomosis to the defunctionalized limb, and (e) caring for internal drainage of secretion from the distal fragment of the completely fractured pancreas and preserving its secretory function.

creatic secretions, tissue necrosis and often blood in the retroperitoneal space. The intraductal pressure causes continuation of the leakage of pancreatic secretion into this area, which in turn causes an ever-increasing collection of fluid. The body sets up a fibrous capsule around this fluid, forming a pseudocyst. These cysts have been known to attain an extremely large size. They cause symptoms varying from a mild sense of fullness to the symptoms caused by pressure on some nearby structure.

Various authors have chosen different methods of treatment.[16] These include marsupialization, internal drainage and excision. Marsupialization is actually the formation of an external fistula. A large percentage of these fistulas persist and must be treated as aforedescribed. Occasionally they can be obliterated by use of a caustic. Excision of the cyst is fraught with hazards, including those of hemorrhage, fistula formation and secondary pancreatitis. Internal drainage appears to be the treatment of choice. This is impossible only when the wall of the pseudocyst is too friable for suturing, in which case one must resort to marsupialization. Both cystogastrostomy and side-to-side cystojejunostomy have been proved useful, but both procedures have the disadvantage that food particles and intestinal contents enter the cyst. Proof that this does harm has not been established, but at least it is theoretically undesirable. Utilization of the en Y defunctionalized limb to produce a cystojejunostomy prevents contamination of the cyst and in each instance has caused its clinical disappearance.

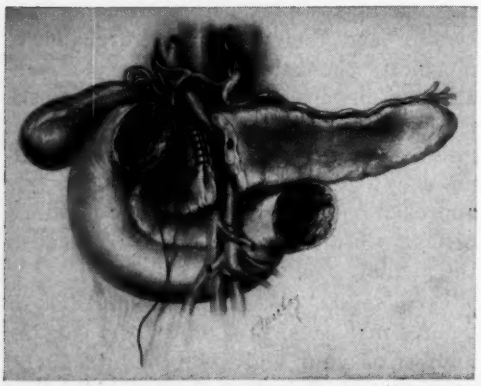

Fig. 1.—Complete severance of pancreas. Severed proximal end of pancreatic duct has been ligated. Torn end of proximal fragment is being closed.

Trauma.—The pancreas is liable to penetrating injuries of many types. These must usually be treated by drainage, and the formation of a fistula results. This fistula, of course, is treated in the same manner as are fistulas resulting from other causes. Nonpenetrating, nonoperative injury of the pancreas is usually caused either by some force pinching the pancreas against the rounded anterior surface of the vertebra or by some torque rupturing the fixed retroperitoneal portion of the pancreas.

Usually one associates severe symptoms with disease of the pancreas; yet the symptoms of injury to this organ may be very mild in comparison with the amount of pancreatic damage. This, apparently, is due to several factors: (1) inactivation of the pancreatic enzymes after injury;[17] (2) a decrease in the rate of secretion after trauma,[18] and (3) the spilling of this irritant into the retroperitoneal tissues rather than into the sensitive peritoneal cavity, which may be a factor in their being interpreted differently. The amount of trauma varies considerably; it may be as light as a mere bruise or as severe as a complete fracture. Whenever there is a ductal rupture, either due directly to trauma or due to necrosis secondary to trauma, there is an escape of pancreatic "juice" that results in a pseudocyst. Treatment of this is the same as for other pseudocysts.

In a patient with complete severance of the pancreas the signs of a ruptured viscus develop in a more subtle manner than if

this material were spilled into the sensitive peritoneal cavity. Eventually, however, the patient comes to operation, usually an exploratory laparotomy. No standard procedure has been adopted to care for these injuries. Most often, in the past, drainage has been employed and has been followed by fistula formation, or the caudal fragment has been excised along with the spleen (excision of the latter being technically mandatory). Both of these methods have certain objectionable facets. The fistula usually requires further surgical measures, but even if it does close spontaneously the period of morbidity is long. Caudal excision with splenectomy is a formidable procedure. It does prevent fistula formation, but, on the other hand, it deprives the patient of the function of the removed portion of gland. Diabetes only occasionally follows subtotal pancreatectomy, yet it has been reported as occurring in 2 of 18 patients operated on by Marshall[19] for hypoglycemia. Granted that this is a slightly different situation, the resulting diabetes must still be a matter of concern whenever any large fragment of the pancreas is excised. The functional reserve of the gland remaining cannot be estimated. The effect of withdrawal of certain amounts of pancreatic secretion from the digestive system cannot be measured, but certainly it is undesirable.

After we had utilized the en Y anastomosis for the pancreatic diseases as has been described, it occurred to us that its use for this condition should be ideal. We have recently treated 2 patients with complete fracture of the pancreas. In both instances the torn end of the duct of Wirsung was ligated on the proximal side and the torn end of the proximal fragment closed with mattress sutures (Fig. 1). The proximal end of the distal fragment was dissected out for a little over 1 cm. and inserted into and anastomosed to the defunctionalized limb of jejunum en Y (Fig. 2).

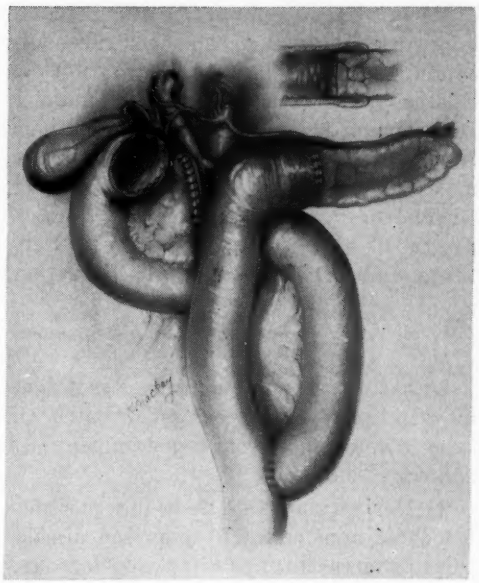

Fig. 2.—Severed end of distal fragment has been dissected up and anastomosed into end of defunctionalized loop to form an en Y pancreaticojejunostomy.

Both patients recovered uneventfully, and the period of morbidity was no longer than that which would be expected after any other major operation. We have been unable to find a description of this application of the Roux en Y anastomosis in the literature.

ZUSAMMENFASSUNG

Die Anwendung der Rouxschen Y-förmigen Anastomose zur Behandlung verschiedener Erkrankungen der Bauchspeicheldrüse wird erörtert.

Diese Form der Anastomose bildet ein sehr zufriedenstellendes Verfahren a) zur völligen Ableitung des Gallenflusses vom System des Pankreas mittels der Choledochojejunostomie, b) zur Heilung von Pankreasfisteln durch ihre Einpflanzung in den funktionslosen Abschnitt, c) zur Heilung von Pseudozysten der Bauchspeicheldrüse mittels Anastomosierung der

Zyste mit dem Jejunum, d) zur Behandlung rückfälliger Bauchspeicheldrüsenentzündungen als Folge von Obstruktion des Ductus pancreaticus mittels kaudaler Drainierung in den funktionsuntüchtigen Abschnitt auf dem Wege über die Anastomose und e) zur Herstellung innerer Drainierung des Sekrets vom distalen Fragment eines völlig gebrochenen Pankreas und zur Erhaltung der Sekretion.

RÉSUMÉ

L'anastomose en Y d'après Roux dans les affections du pancréas est discutée. Ce type d'anastomose offre notamment les avantages suivants:

a) Dérivation totale de la bile par cholédochojéjunostomie; b) guérison des fistules pancréatiques par implantation dans l'organe privé de ses fonctions; c) guérison du pseudokyste pancréatique par cystojéjunostomie; d) traitement de la pancréatite récidivante (obstruction du canal pancréatique) par drainage caudal à travers l'anastomose de l'organe; e) drainage interne de la sécrétion du fragment distal du pancréas rupturé, et préservation de ses fonctions sécrétoires.

RESUMEN

Se trata en este trabajo sobre el empleo de la anastomosis en Y de Roux en diversas enfermedades del pancreas. Tal anastomosis constituye un método satisfactorio de: (a) shunt biliar completo fuera de la vía pancreática en la coledocoduodenostomía; (b) curación de las fístulas pancreáticas implantando en ellas el asa excluida; (c) en la curación del pseudoquiste pancreático por cistoyeyunostomía; (d) en el tratamiento de algunas pancreatitis debidas a obstrucción del conducto por drenaje caudal al asa excluída; (e) en el drenaje interno de la porción caudal del pancreas fracturado.

SUMARIO

Discute o emprego da anastomose de Roux em Y nas varias molestias do pancreas. Considera o metodo satisfatorio para: a) desvia a bile do sistema pancreatico na coledocojejunostomia; b) cura as fistulas pancreaticas pela implantação no sector sem função; c) cura os pseudocistos pela cistojejunostomia; d) combate a pancreatite residual pela obstrução do ducto com a drenagem atraves a anastomose; e) a drenagem interna da secreção do segmento distal preservando a função secretora.

RIASSUNTO

Viene trattato l'impiego dell'anastomosi a Y secondo Roux nella cura di varie affezioni pancreatiche. Questo tipo di anastomosi è molto sofdisfacente in quanto a) devia completamente la bile dal sistema pancreatico mediante la colodocodigiunostomia; b) cura le fistole pancreatiche impiantandole nell'ansa defunzionalizzata; c) cura le pseunocisti pancreatiche mediante la cistodigiunostomia; d) cura la pancreatite recidivante da ostruzione dei dotti pancreatici mediante il drenaggio della coda anastomizzata all'ansa defunzionalizzata; e) cura le fratture del pancreas mediate il drenaggio interno delle secrezioni del frammento distale, rispettandone la funzione.

REFERENCES

1. Deaver, J. B., and Ashhurst, A. P. C.: Surgery of the Upper Abdomen. Philadelphia: P. Blakiston's Son and Company, 1921, p. 332.
2. Pearse, H. E.; Radakovich, M., and Cogbill, C. L.: An Experimental Study of Antiperistaltic Jejunal Loop, Ann. Surg. 129:57-64, 1949.
3. Opie, E. L.: The Etiology of Acute Hemorrhagic Pancreatitis, Bull. Johns Hopkins Hosp. 12:182, 1901.
4. Archibald, E.: The Experimental Production of Pancreatitis in Animals as the Result of the Resistance of the Common Duct Sphincter, Surg., Gynec. & Obst. 28:529, 1919.
5. Gillesby, W. J.: Discussion of a paper by Puestow, C. B., and Gillesby, W. J.: Retrograde Surgical Drainage of Pancreas for Chronic Relapsing Pancreatitis, Arch. Surg. 76:898-905, 1956.

6. Bowers, R. F.: Therapy of Acute and Chronic Pancreatitis, M. Ann. Dist. of Columbia 23:428-432, 1954.

7. Rousselot, L. M.: Sanchez Ubeda, R., and Gianelli, S.: Choledocho-enterostomy in Chronic Relapsing Pancreatitis, New England J. Med. 250:267-272, 1954.

8. Rich, A. R., and Duff, G. L.: Experimental and Pathological Studies on the Pathogenesis of Acute Hemorrhage Pancreatitis, Bull. Johns Hopkins Hosp. 58:212, 1936.

9. Floyd, C. N., and Christopherson, W. M.: Experimental Chronic Pancreatitis, Arch. Surg. 73:701, 1956.

10. DuVal, M. K. Jr.: Caudal Pancreaticojejunostomy in Chronic Relapsing Pancreatitis, Ann. Surg. 140:775, 1954; Pancreaticojejunostomy for Chronic Relapsing Pancreatitis, Surgery 41:1019-1027, 1957.

11. Reynolds, J. T.: Discussion of Poer and Whitaker, Ann. Surg. 133:764-771, 1951.

12. Ellison, E. H.: Discussion of Puestow, C. B., and Gillesby, W. J.: Retrograde Surgical Drainage of Pancreas for Chronic Relapsing Pancreatitis, Arch. Surg. 76:898-905, 1958.

13. Puestow, C. B., and Gillesby, W. J.: Retrograde Surgical Drainage of Pancreas for Chronic Relapsing Pancreatitis, Arch. Surg. 76:898-905, 1958.

14. Culler, R. M.: Cure Pancreatic Fistula by Roentgen Ray, J.A.M.A. 75:20, 1920.

15. Connolly, E. A., and McGreevy, E. J.: Internal Drainage of Pancreatic Cysts, Am. J. Surg. 87:552-562, 1954.

16. (a) Brunschwig, A.: Operative Technique. Edited by Warren Cole. New York: Appleton-Century-Crafts, Inc., 1949, vol. 1, chap. 2, p. 483. (b) Carter, R. F., and Slattery, L. R.: Factors Influencing the Managemnt of Pancreatic Cysts, Surg. Clin. North America 27:411-416, 1947. (c) Cattell, R. B.: Anastomosis of the Duct of Wirsung: Its Use in Operations for Cancer of Head of the Pancras, Surg. Clin. North America 27: 643, 1947. (d) Doubilet, H., and Mulholland, J. H.: Pancreatic Cysts: Principles of Treatment, Surg., Gynec. & Obst. 96:683-692, 1953. (e) Juca, W. R.; Pastnack, G. L., and Bornemeier, W. C.: Roux Y Technique in Internal Drainage of Pancreatic Cyst, J.A.M.A. 156:937-939 (Nov. 6) 1954. (f) Lawson, S. E., and Massey, R. O.: Pancreatic Cysts, Arch. Surg. 68:734-743 (June) 1954. (g) Mahaffey, J. H.; Haynes, B. W. Jr., and DeBakey, M. E.: Surgical Considerations of Pancreatic Cysts with Particular Reference to Internal Drainage, Postgraduate Med. 16:259-269, 1954. (h) Poer, H. D., and Whitaker, W. G.: Further Considerations in the Internal Drainage of Pancreatic Cysts, Ann. Surg. 133:764-771, 1951. (i) Shanahan, T. H.: Cure of Pancreatic Fistula by Pancreaticojejunostomy, Am. J. Surg. 88:516-517, 1954. (j) Warren, K. W.: The Control of Acute and Chronic Pancreatic Pain, Surg. Clin. North America 30:873-883, 1950. (k) Waugh, J. M.: Lewis Practice of Surgery: Vol. VII, Chapter I, p. 22-35, 1952. Hagerstown, Md.: W. F. Prior Company, 1952. Bowers.[6]

17. Howard, J. M.: Surgical Physiology of Pancreatitis, Surg. Clin. North America 29:1789, 1949.

18. Popper, H. L., and Necheles, H.: Pancreatic Injuries, Surg., Gynec. & Obst. 93:621, 1951.

19. Marshall, S. F.: Islet Cell Tumors of the Pancreas Producing Hypoglycemia, Surg. Clin. North America 38:775, 1958.

ADDITIONAL SOURCES

Anand, S. S., and Sawhney, C. P.: Pseudopancreatic Cysts, Their Diagnosis and Treatment: Analysis of 8 Cases, Indian J. Surg. 18:174-184, 1956.

Hannon, D. W., and Sprafka, J.: Resection for Traumatic Pancreatitis, Ann. Surg. 146:136, 1957.

Aretæus the Cappadocian, a physician living in the third century, has left us such accurate and graphic descriptions of disease that they are mute testimonials of his skill in taking and recording histories. Paul of Aegina, who practised medicine in the seventh century, described sixty-two different kinds of pulses he had found in patients . . . But his writings also showed the low state into which the medicine of his day had fallen, for he admits freely that the ancients knew all there was to be known about medicine and confesses frankly that he is merely a humble scribe with no originality, for nothing new or original had been discovered for a thousand years.

—*Major*

Monobloc Resection for Carcinoma

Total Thoracic Esophagectomy, Gastrectomy, Splenectomy and Pancreatectomy; Construction of New Esophagus from Transverse Portion of Colon; Two Operative Stages in One

EDWIN BENEDITO MONTENEGRO, M.D.,*
AND
SATURNINO ANTONIO DA CINTRA FRANCO, M.D.
SAO PAULO, BRAZIL

A new radical procedure for carcinoma, designated as monobloc resection, is described. It combines in a single operation resections and maneuvers that formerly required at least two; it includes total thoracic esophagectomy, total gastrectomy, splenectomy, resection of the body and tail of the pancreas and construction of a new esophagus with the transverse portion of the colon. According to the authors, the terminoterminal anastomosis of the colon and the duodenum makes for better mixing of foods with the duodenal fluid, thus aiding digestion. The operative time is not excessive considering the extent of the operation—in the authors' hands, three hours and forty-five minutes. For cardial carcinoma this technic, in addition to being radical, enables the surgeon to reconstruct the channel of transit immediately. Possible disadvantages are increased surgical shock, the risk of anastomotic dehiscence owing to the poor general condition of the patient and the absence of a gastrostomy for feeding. These will be discussed in a later report, when the results in more cases are available.

THE surgical treatment of carcinoma becomes constantly more radical and calls for a perpetual succession of new technics to repair mutilations done in the attempt to cure the patient.

Construction of a new esophagus with the transverse colon after resection of the thoracic portion of the esophagus is a procedure that has been recommended by us. We usually perform the operation in two stages. The first includes direct total thoracic esophagectomy, together with gas-

*Assistant Professor of Surgery, Medical School of the University of Sao Paulo.
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Fig. 1.—Roentgenogram showing lesion of lower third of esophagus.

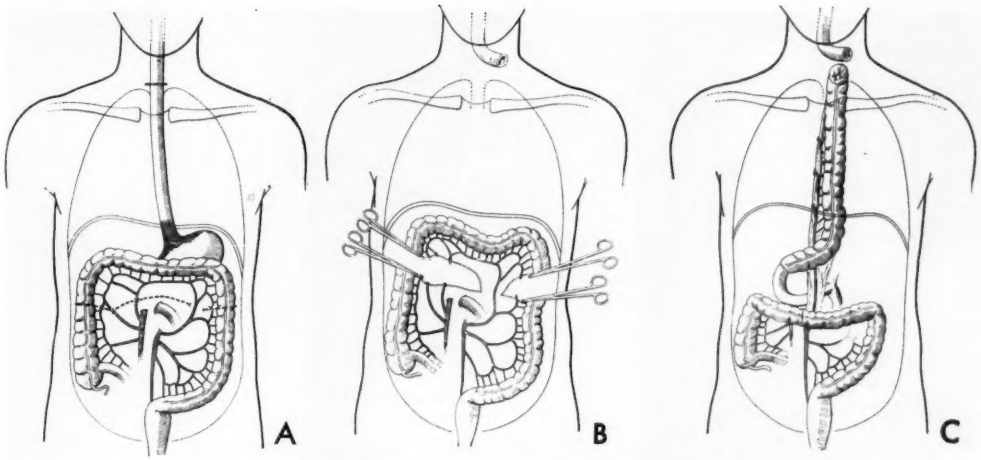

Fig. 2.—Successive steps in operative technic (see text).

trotomy and left cervical esophagostomy. The second consists of the construction of a new esophagus from the transverse portion of the colon, with cervical esophagocolic anastomosis.

In the case to be reported here a more radical technic was indicated, since a neoplasm in the lower third of the esophagus, spreading to the stomach was present. A left thoracolaparotomy was performed, together with resection of the thoracic portion of the esophagus, total gastrectomy, splenectomy and total pancreatectomy, all tissues and organs being removed in monobloc fashion. The transverse portion of the colon was then isolated and lifted up to the neck, where it remained exteriorized. Its other extremity was anastomosed to the duodenum. This type of *en masse* operation seems to be new in the medical literature.

The patient improved for ten days, after which a fistula developed at the level of the duodenum. This fistula was eventually the cause of his death.

COMMENT

This absolutely new technic presents various interesting points:

1. The operation is performed in only one stage, thus sparing the patient the trauma of two major operations as well as the expenditures they involve.

2. It may be performed through only one route of access, i.e. the left thoracolaparotomy.

3. It makes for total resection of the thoracic portion of the esophagus and the gastric monobloc, spleen and pancreas, plainly in accordance with the most radical concept of surgical treatment for carcinoma.

4. The terminoterminal anastomosis of the colon and duodenum makes for better mixing of foods with the duodenal juice, thus aiding digestion.

5. There is no great expenditure of time; the operation requires only three hours and forty-five minutes. So much for the advantages. The disadvantages are as follows:

1. Surgical shock is increased.

2. There is some risk of dehiscence of the anastomosis, owing to the generally unfavorable condition of the type of patient involved.

3. There is no gastrostomy for food in-

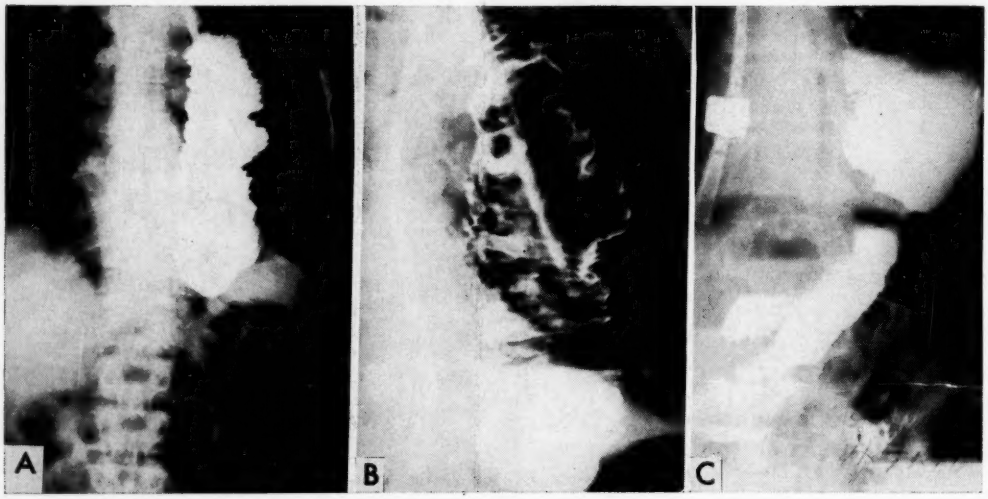

Fig. 3.—Barium roentgen study made on tenth postoperative day. A and B, colon revealed at left hemithorax. C, duodenocolic anastomosis. Fistula that caused patient's death is also visible.

take, in spite of the fact that this can be performed through the neck-exteriorized colon.

A new technic is thus presented, which makes for a more radical operation for tumors of the cardia and also permits immediate reconstruction of the transit. The advantages and disadvantages of this new approach can be discussed only at a future date, its results in more cases can be presented.

Report of Case

J. J. M., a Spanish laborer age 64, had complained of dysphagia for six months, at first for solid food and then for liquids. There was slight retrosternal pain that became worse after meals. The patient had lost a great deal of weight.

Physical Examination—The patient was normolinear and very thin, with scarcely colored mucosae. The abdomen was thin and lax. The epigastrium was somewhat painful and presented a certain degree of impastation.

Laboratory Examination—On May 24, 1957, there were 4,690,000 erythrocytes per cubic millimeter of blood, with 92.8 per cent hemoglobin and a globular value of 1. The leukocytes numbered 5,800 per cubic centimeter. The clotting time was 4 minutes and the sedimentation time 1 minute. Urinalysis revealed urine with an acid reaction and normal sediment.

Roentgen Examination (Fig. 1).—Roentgenograms revealed a tumor in the lower third of the esophagus and the upper part of the stomach.

Surgical Treatment.—Operation was performed on June 12 by Dr. Montenegro with Dr. S. A. da Cintra Franco as first assistant and Dr. Claudio Villa as second assistant. The operative time was three hours and forty-five minutes. Anesthesia was induced by means of 1 ml. of curare, the Aga apparatus being employed. Nitrous oxide was used as an auxiliary anesthetic. The anesthesia was satisfactory, with a decrease in arterial pressure during manipulation of the crux of the aorta. Conditions at the final stage were satisfactory.

Technic (Fig. 2).—A left thoracolaparotomy was performed at the ninth intercostal space, with transverse sectioning of both straight muscles of the abdomen. A tumor of the cardia was present, with infiltration of the terminal part of the esophagus and the cranial part of the stomach. There were no macroscopic metastases. The esophagus was detached as well as the monobloc formed by the spleen and the body and tail of pancreas, i.e., the entire pancreas, together with the great and lesser epiploon. The duodenum was clamped.

The esophagus was sectioned above the lesion so as to permit its exteriorization at the neck, at the left side, where it was marsupialized. The transverse portion of the colon was isolated, which liberated the hepatic and splenic angles. The right and medial colic vessels were ligated; the left ones were employed in the irrigation of the loop to be uplifted to the neck; the colon was sectioned at the level of the ascending and descending portions; colic transit was restored by terminoterminal anastomosis of the colon, with sutures in two planes—the total one with chromium catgut and the external one with separate cotton stitches. In exteriorization of the proximal part of the colon, at the left side of the neck, the incision made for exteriorization of the esophagus was employed. The openings were protected with petrolatum gauze. The cavities were revised, and closure was done by planes. Thoracic drainage was employed, but none was used for the abdominal cavity.

Specimen. — The operative specimen consisted of the entire thoracic portion of the esophagus, the entire stomach, the greater and lesser epiploons, the spleen, and the body and tail of the pancreas. On section, it revealed a carcinomatous lesion of the cardia, extending to the terminal portion of the esophagus and the upper part of the stomach. The anatomopathologic diagnosis was plain cell carcinoma.

Roentgen Control. — In roentgenograms taken on the tenth postoperative day (Fig. 3, *A* and *B*), the barium mixture used as a contrast medium revealed the colon situated at the left hemithorax. Figure 3*C* shows the duodenocolic anastomosis, as well as the fistule that eventually caused the patient's death.

RÉSUMÉ

Une nouvelle technique chirurgicale radicale pour le carcinoma, dite "résection monobloc" est proposée. Elle combine en une seule intervention les différents temps exigeant jusqu'à maintenant au moins deux opérations, et comprend l'oesophagectomie thoracique totale, la gastrectomie totale, la splénectomie, la résection du corps et de la queue du pancréas, ainsi que la création d'un nouvel oesophage au moyen de la portion transverse du colon. L'anastomose terminoterminale du colon et du duodénum permet un meilleur mélange du bol alimentaire au liquide duodénal, favorisant ainsi la digestion. La durée de l'opération n'est pas excessive si l'on considère que les auteurs l'exécutent en 3 h. 45. Pour le carcinome du cardia, outre que cette technique est radicale, elle permet la reconstruction immédiate du canal de transit. Les inconvénients possibles sont un choc opératoire accru, le risque d'une déhiscence anastomotique du fait du mauvais état général du malade, et l'absence de gastrostomie pour l'alimenter. Ces risques feront l'objet d'un exposé ultérieur lorsque les auteurs disposeront des résultats d'un plus grand nombre de cas.

RESUMEN

Se describe en este artículo una nueva técnica para la extirpación del carcinoma llamada resección "monobloc." Combina en una sola operación sesecciones y maniobras que antiguamente requerían por lo menos 2. Esta operación incluye la esofagotomía total torácica, gastrectomía total, explenectomía, resección del cuerpo y cola del pancreas y la construcción de un neo esófago con el colon transverso. Según la opinión de los autores la anastomosis terminoterminal del colon con el duodeno contribuye a una mezcla mejor le los alimentos con el jugo duodenal ayudando así la dijestión. El tiempo que lleva la operación, 3 cuartos de hora en manos del autor, no es excesivo si se tiene en cuenta su magnitud.

En el carcinoma del cardias esta técnica, además de ser radical, permite al autor reconstruir el canal de tránsito sobre la marcha. Las posibles pegas son: mayor shock quirúrgico, peligro de dehisdencia anastomótica debida al bajo nivel general del enfermo y la ausencia de una gastrostomía para la alimentación. Sobre todo esto trataremos más adelante en cuanto tengamos a nuestra disposición más cacos y resultados.

RIASSUNTO

Viene descritta una nuova tecnica per l'asportazione radicale dei cancri, che ha il nome di resezione "monoblocco." Essa riunisce in un unico intervento i procedimenti che prima ne richiedevano almeno due e comprende l'esofagectomia totale transtoracica, la gastrectomia totale, la splenectomia, la resezione del corpo e della coda del pancreas e la ricostruzione dell'esofago mediante il colon trasverso. Secondo gli autori l'anastomosi terminale del colon al duodeno consente un miglior mescolamento dei cibi e quindi una migliore digestione. La durata dell'intervento non è eccessiva in rapporto alla mole dell'asportazione e l'autore la conduce a termine in tre ore e tre quarti. Questa tecnica, oltre ad essere radicale, consente la ricostruzione immediata della continuità intestinale; gli svantaggi possibili sono rappresentati dallo shock, dal rischio della deiscenza dell'anastomosi e dalla mancanza della gastrostomia per l'alimentazione. Ciò sarà trattato in un successivo articolo, quando si avranno a disposizione i risultati di più numerosi casi.

ZUSAMMENFASSUNG

Es wird eine neue radikale als "Einblockresektion" bezeichnete Krebsoperationsmethode beschrieben. Sie vereint in einem einzigen Eingriff Resektionen und Handgriffe, die früher mindestens zwei Operationen erforderten. Das Verfahren umfasst die totale Resektion der thorakalen Speiseröhre, des Magens und der Milz, die Resektion des Körpers und Schwanzes der Bauchspeicheldrüse und die Herstellung einer neuen Speiseröhre mittels des Querdarmes. Die End-zu-End-Anastomosierung des Kolons mit dem Zwölffingerdarm führt nach Angabe der Verfasser zu einer besseren Mischung der Nahrung mit Duodenalflüssigkeit, was zur Verdauung beiträgt. Die Dauer des operativen Eingriffs ist, gemessen an dem Umfang der Operation, nicht übermässig lang und beträgt in den Händen der Verfasser drei Stunden und 45 Minuten. Beim Kardiakarzinom bietet diese Technik abgesehen von der Radikalität dem Chirurgen die Möglichkeit, die Kontinuität des Ernährungskanals sofort wiederherzustellen. Etwaige Nachteile des Eingriffs werden in einer Erhöhung der Möglichkeit chirurgischer Schockwirkung, in dem Risiko von Rissen der Anastomosen auf Grund schlechten Allgemeinzustandes des Kranken und im Fehlen einer Magenfistel für Ernährungszwecke gesehen. Über diese Nachteile wird in einer späteren Arbeit berichtet werden, wenn die Ergebnisse in einer grösseren Anzahl von Fällen zur Verfügung stehen.

Correction: The Editors regret that in the April issue of the *Journal* an error appeared in the name of one of the authors, Dr. D. Kopel of Belize, British Honduras, the initial *D* having been misread as *I*. Sincere apologies are offered to Dr. Kopel and to *Journal* readers.

Mechanical Intestinal Obstruction and Ileus: Use of Procaine Hydrochloride in Differential Diagnosis and as a Therapeutic Agent

LEON A. FRANKEL, M.D., M.S. (Surg.), F.I.C.S.
PHILADELPHIA, PENNSYLVANIA

THE original observation of this clinical study dates back to April 29, 1957, when a few cc. of sterile procaine hydrochloride (1 per cent) was introduced into the abdomen to attempt peristaltic stimulation in a case of questionable viability of a segment of small bowel. This was repeated empirically until June 20, when a definite impression as to the potentiality and diversification of its use became significant.

At this time Mrs. H. B., aged 50, was admitted to the St. Luke's and Children's Medical Center of Philadelphia, having undergone a supracervical hysterectomy three years earlier.

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The author presents an account of his experience with the use of procaine hydrochloride, which he has found valuable in the diagnosis, treatment and postoperative care and prognosis of mechanical intestinal obstruction and ileus. Introduced into the gastrointestinal tract by means of an indwelling tube, by fistulization (cecostomy), or through an abdominal catheter into the peritoneal cavity, this drug in his hands has revealed advantage after advantage, each of which is described. One case is reported in detail and a number of others are summarized.

Her subjective symptoms were vomiting and distention of three days' duration. The last bowel movement had occurred six days prior to hospitalization.

A working diagnosis of obstruction of the small bowel was made. This was corroborated by roentgen examination. In addition to evidence of fluid and electrolyte imbalance, diabetes and acidosis were present.

An Abbott-Miller tube was passed, decompression started and supportive electrolytes and fluids administered. The patient appeared to be improving, but on June 23 distention again became pronounced, despite intestinal siphonage. The patient was taken to the operating room, where massive small bowel adhesions were observed, with kinking of the bowel upon itself and points of fixation to the midportion of the descending colon.

The entire small bowel was traced and all adhesive points liberated. The viability of the small bowel where it had been fixed to the colon was so poor, however, that this segment (19 cm.) was resected and reapproximated. Pelvic drains were introduced and brought out through lateral stab wounds.

For the following three days the patient improved, and, although no peristalsis was heard until June 26, the abdomen remained flaccid. On June 27 peristalsis was active and audible, and on June 28 was accompanied by the passage of flatus and feces. The temperature, pulse rate and respiratory rate were within normal limits. On the morning of June 29 a portion of a drain was removed.

Early that evening the patient became restless and distended; nausea was present despite the use of suction; peristalsis was absent; the output of urine became decidedly limited, and there was a considerable rise in temperature, pulse rate and respiratory rate.

On this occasion a portion of the terminal third of the ileum was observed once again

to be acutely kinked and attached to the rectosigmoid, a condition not present on June 23, and the previous anastomotic site was in process of good repair, with a normally functioning stoma. The small bowel distal to the site of the kinking was collapsed and led to a greatly dilated and thinned cecum and ascending colon. There were no grossly visible or palpable lesions in the transverse colon, and the remainder of the large bowel was collapsed. The obstructed site was liberated, and a cecostomy was performed by use of a Foley catheter (no exteriorization was done because of a severely attenuated cecum). When the anesthetist attempted the introduction of intravenous fluids he encountered thrombosed veins, withdrawing a thrombus approximately 3 inches (7.5 cm.) long from the right basilic vein.

From the time of admission to the hospital, multiple sites on both upper extremities were used for the introduction of intravenous feedings, because of occlusion areas. Cut-down and polyethylene catheters were resorted to, with use of whatever vessels were available about the ankles, feet and thighs. Other adjuncts were used, such as hypoclysis, ice bags, ACTH, Levofed, Solucortef and antibiotics.

The temperature rose to 105 F., at which time the patient became occasionally irrational. The blood pressure in millimeters of mercury dropped to 80 systolic and 50 diastolic. The output of urine for the previous twenty-four hours was 150 cc., Wangensteen drainage 125 cc. and cecostomy drainage 50 cc. The prognosis looked hopeless.

At this time the experience on April 26 was recalled. Since the patient was *in extremis*, the use of any possible method of salvage was considered justifiable. Two cc. of sterile procaine hydrochloride (1 per cent) was timidly introduced into the Levine tube, and a stethoscope was applied to the abdomen while the patient was observed. About thirty seconds later she was seen to grimance and upon inquiry stated that she was having "griping pain." Auscultation revealed periodic peristaltic waves, which lasted about ten minutes. Two cc. of the solution was introduced into the cecostomy catheter, and approximately forty-five seconds later peristalsis again commenced and lasted for about five minutes. With this method apparently bearing fruit, the amount of procaine was increased (up to 10 cc.). and it was given at regular intervals, depending upon the intensity of the peristaltic effort.

On July 2 the temperature had dropped to 99 F, the blood pressure was 112 systolic and and 70 diastolic and the patient passed flatus for the first time in twelve days. On the following evening she refused any narcotic, saying "I don't have much pain." From this point on her progress continued steadily and she left the hospital on July 21, with the cecostomy fistula healed. She was eating and drinking well and having normal bowel movements. Up to the time of writing she has had no recurrence of the symptoms and has gained 40 pounds (18.1 Kg.) in weight.

Since the first personal observation of the intragastric, intestinal or abdominal effect of procaine hydrochloride upon bowel activity the use of the drug has aided success in the following instances: (1) determining the type of intestinal block; (2) where peristalsis could not be initiated or maintained the presence of a mechanical obstruction was suspected and proven; (3) alleviating and, in the presence of peritoneal contamination, overcoming ileus, and (4) overcoming the negative intra-intestinal pressure and thus instituting local or propulsive peristalsis. This increased the amount of Wangensteen siphonage, thus overcoming intestinal distention. From this point on, if paralytic ileus was present, peristalsis continued to a successful conclusion if uncomplicated by mechanical obstruction.

OUTLINE OF ADDITIONAL CASES

B. H., 4/29/57: Sigmoid diverticulitis with chronic ulceration, perforation; 6/5/57, mechanical obstruction of ileum 1½ feet (38.26 cm.) proximal to ileum (resection 10 cm.).

M. F., 6/3/57: Chronic calculous cholecystitis with acute exacerbation; adhesion of small bowel to site of previous appendectomy; ventral hernia.

B. H., 6/23/57: Chronic nonspecific ulceration of small bowel; chronic peritoneal adhesions with partial obstruction of small bowel (resection 19 cm.).

M. B., 7/2/57: Acute perforative suppurative appendicitis with peritonitis.

A. W., 7/23/57: Cholecystitis: severe acute reactivation with calculosis.

J. B., 7/30/57: Acute hemorrhagic appendicitis.

S. P., 7/30/57: Small bowel adhesions; lysis.

C. Z., 8/11/57: Obstruction of small bowel; polycystic ovaries; pelvic endometriosis.

G. R., 9/9/57: Obstructive (fecolith) appendicitis; ileus.

C. I., 9/16/57: Volvulus of small bowel with hemorrhagic infarction and gangrene; resection; 2/10/51, perforation and closure of duodenal ulcer, U. S. Naval Hospital; 4/23/57, colostomy; 4/27/57, gastrojejunostomy; 5/29/57, closure of colostomy; discharge note, "He again recovered nicely but epigastric pains recurred. X-Rays revealed persistence of the gastric ulcer and marked narrowing of the gastro-enterostomy with most of the barium leaving the stomach through the pylorus."

N. B., 9/30/57: Chronic adhesive peritonitis; obstruction of small bowel (resection 15 cm.).

H. H., 10/3/57: Adenocarcinoma of stomach; resection.

C. W., 10/6/57: Adenocarcinoma of rectum; resection.

C. K., 10/18/57: Acute perforative and suppurative appendicitis with acute suppurative peritonitis and mesoappendicitis.

G. M., 11/11/57: Acute gangrenous appendicitis with suppuration and mesoappendicitis.

F. C., 12/4/57: Calculous cholecystitis.

A. G., 12/9/57: Calculous cholecystitis.

C. F., 1/6/58: Pyloric ulcers (multiple), gastric resection.

A. W., 2/1/58: Perforated gastric ulcer, closure (refused further surgical treatment).

F. H., 2/10/58: Duodenal ulcer; gastric resection.

H. S., 2/14/58: Acute suppurative appendicitis with suppurative peritonitis and mesoappendicitis, small bowel adhesions and obstruction.

T. M., 2/15/58: Bowel obstruction; chronic adhesive perienteritis with stricture of small bowel (resection 13 cm.).

E. T., 2/19/58: Acute suppurative cholecystitis, pericholecystitis; ileus.

L. W., 3/3/58: Bowel obstruction; chronic adhesive peritonitis; focal hemorrhage of mesentery (resection 10 cm.).

S. N., 3/11/58: Bowel obstruction; acute sigmoid diverticulitis.

E. H., 3/16/58: Small bowel obstruction; colonic diverticulosis; acute obstruction of jejunum, with early hemorrhagic infarction.

S. C., 3/17/58: Duodenal ulcer; gastric resection.

R. R., 4/2/58: Duodenal ulcer; gastric resection; infarction of proximal portion of ileum (resection 17 cm.).

N. B., 4/8/58: Postoperative small bowel obstruction; lysis of adhesions.

M. O., 4/26/58: Acute suppurative appendicitis; acute suppurative mesoappendicitis.

G. Y., 4/29/58: Omental and small bowel adhesions; partial bowel obstruction.

M. H., 5/12/58: Calculous cholecystitis.

C. B., 6/16/58: Pancreatic abscess; perirenal abscess; obstruction of hepatic flexure; coronary insufficiency; death three months after operation.

S. F., 6/27/58: Incarcerated scrotal hernia; partial small bowel obstruction.

D. C., 6/29/58: Uterine fibromyomas; pelvic endometrial cyst; small bowel adhesions.

W. G., 7/2/58: Acute gangrenous ruptured appendicitis; acute suppurative peritonitis.

W. M., 7/7/58: Fungating adenocarcinoma of stomach; gastrectomy.

A. M., 8/1/58: Infarction and gangrene of middle third of ileum; resection.

D. S., 8/4/58: Acute suppurative perforated appendicitis; acute suppurative peritonitis.

L. W., 8/4/58: Uterine fibromyomas; bilateral salpingo-oophoritis; pelvic adhesions.

E. W., 8/6/58: Intraligamentous ovarian cyst; focal hemorrhage of omentum; small bowel adhesions.

T. S., 8/8/58: Acute suppurative hemorrhagic appendicitis.

A. F., 8/12/58: Small bowel obstruction; diabetic acidosis; coronary insufficiency; pulmonary edema; not operated on; death eight days after admission.

A. S., 8/13/58: Adenocarcinoma of stomach; gastrectomy.

W. S., 8/26/58: Focal infarct of small bowel with hemorrhage and obstruction (resection 13 cm.).

L. M., 8/21/58: Adenocarcinoma of colon; generalized carcinomatosis; colostomy.

A. W., 9/7/58: Uterine fibromyomas; omental and small bowel adhesions.

S. N., 9/14/58: Revision of colostomy; colonic resection; anastomosis.

D. R., 9/16/58: Duodenal ulcer; gastrectomy.

W. A., 9/28/58: Acute obstructive appendicitis; ileus.

J. R., 10/5/58: Duodenal ulcer; gastrectomy.

D. S., 10/9/58: Acute suppurative appendicitis.

E. E., 10/14/58: Adenocarcinoma of left transverse colon; ileocolic fistula: ileoileal fis-

tula; large and small bowel obstruction; death five weeks after operation from pulmonary edema and right heart failure.

M. O., 10/23/58: Perforated gastric ulcer; peritonitis; closure; 11/4/58, pelvic abscess; small bowel obstruction; lysis.

P. F., 10/18/58: Multiple lacerations of chest, abdomen, arms, right lung, hemothorax and ileus.

M. L., 11/12/57: Chronic large bowel obstruction (massive fecoliths); gangrene of large bowel; arteriosclerosis; hypoproteinemia; atelectasis; acidosis; cecostomy (local anesthesia); death eight days after hospitalization, twelve days after onset of illness).

R. B., 11/25/58: Acute suppurative gangrenous appendicitis; ileus.

O. F., 12/5/58: Eventration of diaphragm, organoaxial volvulus of stomach; chronic adhesive perisplenitis.

A. W., 12/18/58: Perforated gastric ulcer; subtotal gastrectomy (immediate).

H. S., 1/12/59: Extensive left scrotal hernia; small bowel adhesions.

M. V., 1/14/59: Ventral hernia; chronic adhesive peritonitis; partial small bowel obstruction; resection.

E. J., 1/16/59: Chronic adhesive calculous cholecystitis; hypoproteinemia.

F. J., 1/17/59: Bleeding duodenal ulcer; hepatic vein thrombosis (Budd-Chiari syndrome).

R. W., 1/19/59: Acute suppurative appendicitis; suppurative peritonitis.

It appears that this agent directly affects the postganglionic fibers of the parasympathetic nervous system which arise from cells situated in or in close proximity to the innervated organ, resulting in increased tone and motility of both the small and the large intestine.[1]

Experimentally, procaine hydrochloride has been injected intraperitoneally, resulting in inexcitability of the splanchnic and vagus nerves and allowing peristalsis to occur.[2]

It has also been observed that under the influence of procaine hydrochloride there is a relation to the suppression or exclusion of the "slow" impulse which was experimentally observed under the chemical stimuli on its receptors of the intestines, and the "quick" impulse arising upon stimulation of the Vater Pacinian corpuscles.[3]

A speculative generalization has led some to speak of the activities of the sympathetic divisions as catabolic and the parasympathetic divisions as anabolic.[1]

In the cases presented, as time and experience progressed, doses of 2 to 10 cc. of 1 or 2 per cent sterile procaine hydrochloride were introduced into the alimentary canal by means of a Levine tube, through a cecostomy opening or directly into the peritoneal cavity by means of an abdominal catheter. In some instances all three methods were utilized depending upon the circumstances in the particular case. Occasionally prostigmine was used minimally.

For gastrectomy, the use of the drug was started as early as twenty-four hours after the operation. The interval between administrations varied from two minutes to four hours. If peristalsis can be initiated, sometimes as soon as ten seconds after its introduction (though perhaps segmental at onset) and can be maintained, with subsequent expulsion of feces and flatus, it follows that no mechanical lesion is involved. If, however, after repeated doses (in close observation and abdominal auscultation) weak or segmental peristalsis cannot be sustained, one can gather a mental picture of mechanical obstruction that can be corroborated by roentgen study. The fact that surgical intervention is indicated may be recognized much earlier and more readily than heretofore.

The use of the drug as described affected the blood pressure only negligibly and had little effect on the pulse rate. In many instances intestinal decompression seems to come to a standstill, and Levine tubes are replaced by Abbott-Miller tubes, hand siphonage by electrical suction and vice versa, and all of them are categorized as "no good." All one need do to prove or disprove this conclusion is to introduce

2 to 10 cc. of the solution through the intestinal tube, clamp it off for two to five minutes or so as the auscultation indicates, then open it; siphonage will occur as the result of elimination of negative pressure within the particular area of the intestinal tract. With a Foley catheter in place one may notice the increase in output of urine as peristalsis becomes normal, thus indicating the relation of intestinal motility to renal excretory function.

In some of the cases slight "gastrointestinal" bleeding occurred. Experience has taught that, despite this, if peristalsis is maintained, one can assume that this is due to minimal local disease. Close observation will reveal the disappearance of blood and a return to normal drainage. If, however, bleeding persists, or increases and a loss of peristalsis is noted after repeated instillations, one is forced to assume the possibility of gross disease.

SUMMARY

Procaine hydrochloride, introduced into the gastrointestinal tract by an indwelling tube, by fistulization (cecostomy) or through an abdominal catheter into the peritoneal cavity, offers the following advantages:

1. It can be used as a diagnostic sign in differentiating between intestinal obstruction and ileus. If motility, including peristalsis, is initiated within seconds to minutes, maintains or increases its tones, and may disappear yet recur with additional introduction of this agent, one may conclude that surgical intervention is not required immediately. The assumption is that there is temporary inhibition of the peristalsis, of myogenic or neurogenic origin.

2. Clinically it appears that there is a positive or a negative concomitant effect on the extrinsic or intrinsic nerve supply of the intestine and upon myogenic tonus (with or without the ability to initiate segmental or propulsine intestinal activity), all of this being dependent upon the viability of the bowel from either the nutritional or the mechanical standpoint.[4] If the effect is positive it appears that the lesion is not only segmental but propulsive, and contradicting experimental data previously reported. Therapeutically, peristalsis can be initiated earlier in the managment of ileus due to either intrinsic or extrinsic factors.

3. Injected immediately after a gastrointestinal operation (in the presence or absence of peritoneal contamination) or secondary to an earlier operation (mechanical obstruction) in an attempt to initiate early intestinal motility, procaine hydrochloride has been used with success.

4. The prognosis of intestinal activity can be determined early by this means, thus obviating the need of operation (ileus) or performing it promptly (obstruction).

5. Postoperative alimentation may be established much earlier with this procedure than without it.

RÉSUMÉ

Le chlorhydrate de procaïne, introduit dans le tube digestif au moyen d'une sonde à demeure par fistulisation (caecostomie) ou á travers le catheter abdominal dans la cavité péritonéale, offre les avantages suivants:

1. Il peut être utile pour le diagnostic différentiel entre une obstruction intestinale et un iléus. Si la motilité (y compris le péristaltisme) se manifeste après quelques secondes ou minutes, pour rester ensuite stationnaire ou augmenter (elle peut aussi disparaître puis réapparaître avec une dose additionnelle de chlorhydrate de procaïne), on peut en déduire que l'infervention chirurgicale n'est pas urgente. L'on peut supposer qu'il se produit une inhibition temporaire du péristaltisme, d'origine myogène ou neurogène.

2. Cliniquement, il semble qu'il y ait un effet concomitant postif ou négatif sur le tonus nerveux extrinsèque ou intrinsè que de l'intestin et sur le tonus myogène (avec ou sans déclanchement d'une activité intestinale segmentaire ou d'un effort de propulsion) ; ces phénomènes sont liés à la viabilité de l'intestin, du point de vue soit alimentaire soit mécanique. En cas de résultat positif il semble que la lésion ne soit pas seulement segmentaire mais propulsive et en contradiction avec les données expérimentales rapportées antérieurement. Au point de vue clinique le péristaltisme peut être déclanché de façon plus précoce dans le traitement de l'iléus dû à des facteurs soit intrinsèques soit extrinsèques.

3. Le chlorhydrate de procaïne a été utilisé avec succès en injections immédiatement après une intervention gastro-intestinale (avec ou sans contamination péritonéale), ou secondairement à une opération antérieure (obstruction mécanique), afin detenter de déclancher une motilité intestinale précoce.

4. Cette méthode permet un pronostic précoce de la fonction intestinale, elle peut éviter une opération ou permettre de la pratiquer d'urgence (obstruction).

5. L'alimentation postopératoire peut être commencée beaucoup plus tôt grâce à cette méthode.

RIASSUNTO

La procaina introdotta nel tubo gastro-enterico attraverso una sonda, o una fistola (cecostomia) o un catetere addominale, offre i seguenti vantaggi:

1. Può servire come segno diagnostico per differenziare l'occlusione intestinale dall'ileo. Se la peristalsi compare entro pochi secondi o minuti, si mantiene o aumenta di tono, scompare ma poi riprende dopo un'ulteriore aggiunta di medicamento, si può concludere che l'intervento chirurgico non è necessario immediatamente. Significa che vi è una temporanea inibizione della peristalsi di natura neurogena o miogena.

2. Clinicamente si manifesta un effetto concomitante, negativo o positivo, sull-innervazione intrinseca o estrinseca dell'intestino e sul tono miogeno (con o senza possibilità di iniziare un'attività intestinale segmentaria o propulsiva) tutto ciò in rapporto con le condizioni dell'intestino, sia dal punto di vista nutritivo che meccanico. Se l'effetto è positivo appare che la lesione è non solo segmentaria ma propulsiva. Dal punto di vista terapeutico la peristalsi può essere iniziata presto nella cura dell'ileo da cause intrinseche o estrinseche.

3. La procaina è stata usata con successo per stimolare precocemente la motilità intestinale, iniettandola immediatamente dopo interventi sul tubo digerente, con o senza contaminazione peritoneale, o dopo interventi per ostruzione meccanica.

4. La prognosi sulla attività intestinale può essere stabilita precocemente con questo metodo, evitando così interventi non necessari o consigliandone la pronta esecuzione (ostruzioni).

5. L'alimentazione post-operatoria può essere cominciata più precocemente con questo metodo che senza di esso.

SUMARIO

Cita as seguintes vantagens da introdução do cloridrato de procaina no trato gastro-intestinal por tubagem, fistulisação (cecostomia) e cateter abdominal:

1. Pode ser usado como sinal diagnostico entre obstrução e ileo. Se a motilidade é iniciada dentro de segundo ou alguns minutos, se mantem ou aumenta o tonus, pode-se concluir que a intervenção cirurgica não será necessaria. immediamente.

Nesse caso a inibição tenporaria do peristaltismo é de origem miogenica ou neurogenica.

2. Parece clinicamente que há um efeito concomitante, positivomou negativo, no inervação do intestino e sobre o tonus miogenico, tudo dependente da viabilidade intestinal em face de suas condições mecanicas ou de nutrição. Se o efeito é positivo parace que a lesão não é somente segmentaria mas tambem propulsiva e contradisendo os achados experimentais previamente referidos. A peristalse, terapeuticamente, pode ser iniciada mais cedo no tratamento do ileo devido a factores intrinsecos ou extrinsecos.

3. O cloridrato de procaina tem sido usada com sucesso, injetada imediatamente apos a operação gastro-intestinal (em presença ou ausencia de contaminação peritoneal) ou secundariamente a uma operação precoce (obstrução mecânica).

4. O prognostico da atividade intestinal pode ser determinado mais cedo por êsse meio obviando assim anecessidade de uma operação ou indicando-a prontamente (obstrução).

5. A alimentação pos-operatoria poderà ser utilisada mais cedo com o processo em causa do que sem ele.

RESUMEN

El hidrocloruro de procaína, cuando introducido en el tracto gastro-intestinal por una ronda gástrica, por una fístula (cocostomía) o, por medio de un catéter abdominal, en la cavidad peritoneal, ofrece las siguientes ventajas:

1. Puede ser usado como un test diferencial en el diagnóstico entre obstrucción intestinal e íleo. Si se incicia la movilidad, incluso el peristaltismo, en los primeros segundos o minutos, y mantiene o aumenta su tono, y una vez desaparecida vuelve a parecer con una nueva administración de la droga puede sacarse en consecuencia que no se necesita en estos casos de una inhibición temporal del peristaltismo miogénica o neurogénica.

2. Clínicamente parece tratarse de un efecto concomitante positivo o negativo en la inervación intrínseca o extrínseca del intestino y sobre el tono miogénico (con o sin capacidad de iniciar actividan intestinal segmentaria) siendo todo ello dependiente de la viabilidad del intestino desde el punto de vista nutritivo o mecánico. Si el efecto es positivo parece ser que la lesión será no solo segmentaria sino propulsiva contradiciendo así los datos experimentales. Terapeuticamente el peristaltismo puede ser iniciado antes en el tratamiento del íleo debido a factores intrínsecos o extrínsecos.

3. El hidrocloruro de procaína ha sido usado con éxito inyectado inmediatamente después de una aperación gastrointestinal (en presencia o en ausencia de contaminación peritoneal) o secundariamente a una operación anterior (obstrucción mecánica) con el fin de iniciar la motilidad intestinal precoz.

4. El pronóstico de la actividad intestinal puede ser determinado precozmente por este método evitando la operación en unos casos (íleo) o practicándola prontamente (obstrucción).

5. La alimentación el el preoperatorio puede iniciarse mucho antes con este procedimiento que sin él.

ZUSAMMENFASSUNG

Die Einfuehrung von Novocain in den Magendarmkanal mittels eines liegenbleibenden Magenschlauches oder durch eine Fistel (Zoekumfistel) oder in die Peritonealhoehle mittels eines Bauchhoehlenkatheters bietet folgende Vorteile:

1. Es laesst sich als diagnostisches Mittel zur Unterscheidung zwischen einem Darmverschluss und einem paralytischen Ileus verwenden. Wenn innerhalb von Sekunden oder Minuten Bewegung des Darmes einschliesslich Peristaltik einsetzt und der Darmtonus bestehen bleibt oder sich verstaerkt, und wenn die Darmtaetigkeit nach ihrem Aussetzen durch zusaetzliche Zufuhr des Mittels wieder ein-

tritt, kann man annehmen, dass chirurgischer, Eingriff nicht sofort notwendig ist. Man hat die Vorstellung, dass es sich um eine zeitweilige Hemmung der Peristaltik auf myogener oder neurogener Grundlage handelt.

2. Klinisch sieht es so aus, als ob das Novocain einen positiven oder negativen Einfluss auf die aeussere oder innere Nervenversorgung des Darmes und auf den myogenen Tonus (mit oder ohne Moeglichkeit, eine segmentaere oder propulsive Darmtaetigkeit in Gang zu setzen) ausuebt; das alles haengt davon ab, ob der Darm ernaehrungsmaessig oder mechanisch gesehen lebensfaehig ist. Kommt es zu einem positiven Effekt, so handelt es sich offenbar nicht nur um eine segmentaere, sondern um eine propulsive Erkrankung, was frueher veroeffentlichten Versuchsergebnissen widerspricht. Therapeutisch laesst sich auf Grund innerer oder aeusserer Faktoren die Peristaltik bei der Behandlung des Ileus frueher in Gang bringen.

3. Novocaineinspritzungen unmittelbar nach einer Magendarmoperation (mit oder ohne Bestehen peritonealer Verunreinigung) oder nach einer frueheren Operation (mechanischer Darmverschluss) haben sich zur Erzielung fruehzeitiger Darmbewegung mit Erfolg anwenden lassen.

4. Die zu erwartende Darmtaetigkeit laesst sich auf diese Weise fruehzeitig vorausbestimmen, und damit kann die Notwendigkeit eines Eingriffes ausgeschlossen (Ileus) oder die Operation sofort ausgefuehrt werden (mechanischer Verschluss).

5. Die postoperative Ernaehrung kann mit Hilfe dieses Verfahrens viel frueher begonnen werden als ohne es.

REFERENCES

1. Best, and Tayler: Physiological Basis of Medical Practice. 5th ed., 1950, 1080-1083.
2. Hortolme, N.; Busu, I., and St. Roman,: Experimental Support for the Use of Novocain Perfusions in Surgery, Rumanian M. Rev. 81-87, 1957.
3. Anikina, N. A.: Electrophysiological Investigation of the Mechanism of Chemoreception, Bull. Exp. Biol. J. Med. 41:643, 1956.
4. Allen; Harkins; Moyer, and Rhoads, Surgery, Principles and Practice. 1957, p. 866.

Lister's great discovery revolutionized surgery. Thanks to his labours, operations can now be performed without risk which before his time would have meant certain death to the patient. It has been said that Lister saved every year the lives of more men than Napoleon killed in all his campaigns.

—*Ogilvie*

Cardiovascular Surgery

A Seriograph for Angiographic Study of the Limbs

T. MAREGA, M.D., AND L. POSSATI, M.D.

FLORENCE, ITALY

The authors describe a roentgen apparatus for angiographic investigation, with which serial roentgenograms of the entire limb under examination can be taken in close rhythmic succession. The advantages of this method are many, and an important point is that all phases of filling of the arteries with the contrast medium can be photographed, thus frequently revealing pathologic change that might otherwise escape notice. The authors have employed the apparatus for the past three years, with the utmost satisfaction.

EXPERIENCE has clearly demonstrated that taking a single roentgenogram centered at the level presumably involved in a morbid process, is completely insufficient, because the images obtained depend upon the particular moment of filling of the segment concerned and do not, obviously, demonstrate the modifications of other vascular segments of the limb under examination.

In the study of occlusive arterial disease, for example, it often occurs that a single arteriogram shows, at times very clearly, the seat of the occlusion, but fails to indicate its extension or the condition of the collateral circulation.

On the other hand, in the presence of these morbid conditions it is of maximum importance to determine whether a refilling of the principal arterial pathways of the limb below the occlusion has occurred. In agreement with the majority of authors, we consider this factor extremely valuable in both prognosis and therapy.

The necessity of performing serial angiographic examinations, however, is not limited to the study of occlusive vascular disease. The technic is also particularly useful in the diagnosis of arteriovenous fistulas of the limbs, a phase of pathology still in evolution and which at present is stimulating the interest of many students of angiology.

We must remember that semiologically numerous methods are used to show pathologic arteriovenous short circuits: oscillometric tests, cutaneous thermometric studies, measurement of the "femoral artery-tongue" circulation time, the test for oxygen saturation of the venous blood, phlebographic study and finally arteriographic examination.

The last-mentioned method is held *a priori* the most rational, notwithstanding the fact that direct angiographic visualization of the arteriovenous shunt is not always easy, since as a rule one is dealing

From the Orthopedic Institute and Orthopedic Clinic of the University of Florence, and the Surgical Clinic of the University of Bologna, Italy.

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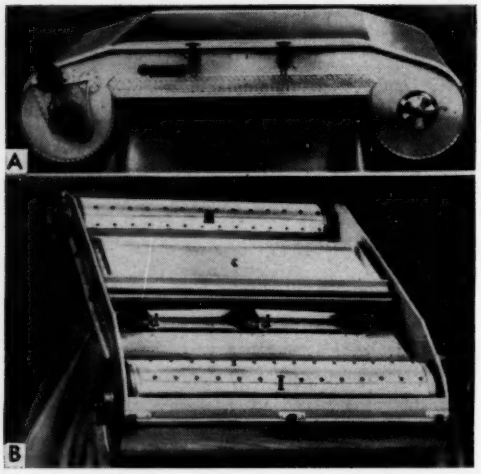

Fig. 1.—*A*, apparatus closed. During exposure, aluminum cover is partially covered by two lead sheets that limit length of roentgenogram. *B*, apparatus open. I, roller provided with spring that rolls up film once it has been exposed; II, roller that carries film to be exposed; *c*, reinforcing screens 30 by 100 cm., inferior and superior, between which film runs (superior fixed, inferior mobile); *d,d,d*, electromagnets that press inferior screen against superior during passage of roentgen rays.

with minute communications situated at the peripheral extremity of a limb, and also because interpretation of the images obtained with a single exposure is often both difficult and unconvincing. In relation to this problem Robertson, in a report presented to the International Congress of Surgery (Lisbon, 1955) stated that of 20 subjects, who were later shown to have pathologic arteriovenous fistulas, only 5 of the fistulas were demonstrable angiographically.

Without direct visualization, arteriographic study can supply an indirect sign to which we assign great importance: the precocious filling of the vein, which, according to Fontain and others, assumes pathognomonic value whenever it occurs in the leg within fifteen seconds from the time of injection of the contrast medium.

It is obvious that in order to estimate with chronologic precision the time taken for the contrast medium injected into the arterial tree to reach the venous territory it is indispensable to have an apparatus capable of automatic taking of various roentgenograms of the entire limb in close, rhythmic succession.

These are, therefore, the reasons that induced us to study and develop a seriograph capable of solving the aforementioned problems.

Among the various systems devised up to the time of writing, preference was oriented towards those with the roentgen film arranged between two reinforcing screens, a system already adopted for angiocardiographic investigation, with infrequent success, by Gobin, Duvezin, Dotter-Steinley, Gidlund and Desgrez.

Description of Apparatus and Technic of Examination.—The seriograph is composed of two rollers on which are fixed a roentgen film 100 cm. wide and of varying length, depending upon the necessities of the investigation and on the number of roentgenograms to be taken and their size (Fig. 1*A*).

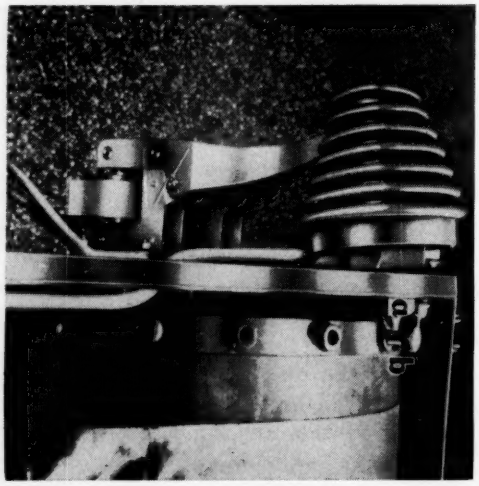

Fig. 2.—Detail of head roller II, seen in profile; *a*, stop-tooth that strikes against cog (*b*) fixed on head of roller.

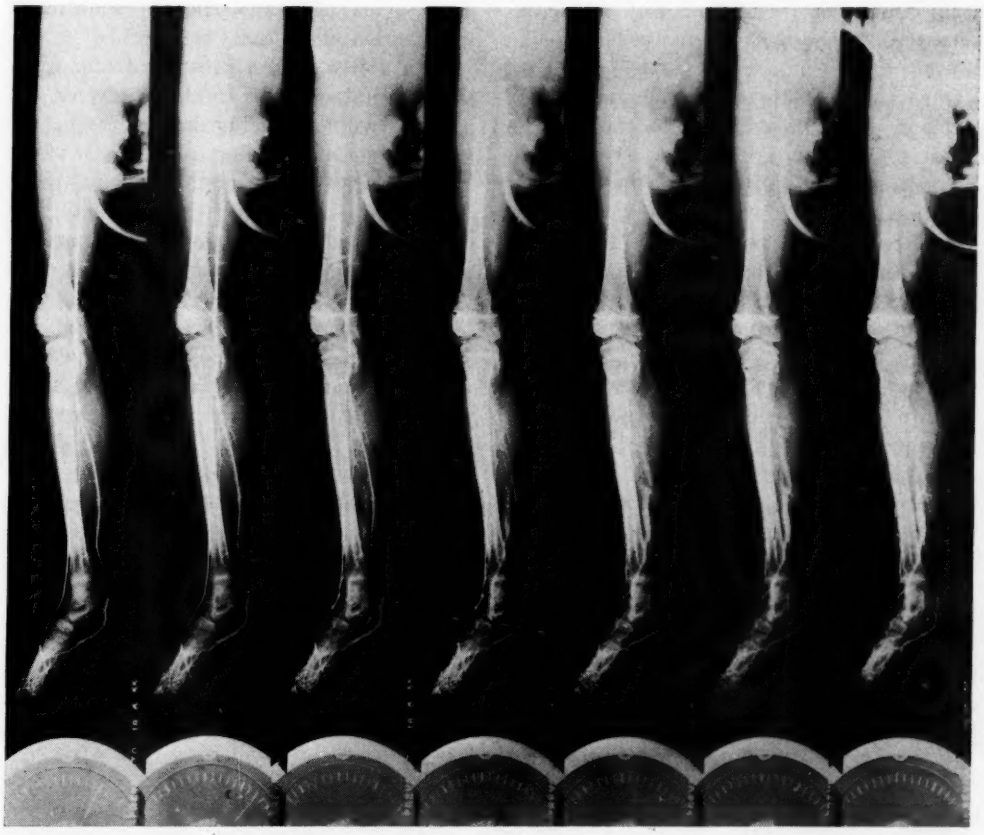

Fig. 3.—Hypertrophic hemangiectasis of lower part of right leg (exposures made every two seconds). In second roentgenogram, injection of a vein in lower third of leg can be noted, which in succeeding plates is identifiable as posterior tibial vein. Diagnosis was arteriovenous aneurysm between posterior tibial artery and vein.

One of the rollers is provided with a spring, which unrolls the film wound on it into the other roller and which is kept fixed by a "stop-tooth." The "stop-tooth," which is made to function by means of an electromagnet, strikes against a series of cogs arranged on the head of the roller at distances that can be varied as desired (Figs. 1*B* and 2).

The film, halfway between the rollers, runs between two reinforcing screens which, at the moment of exposure, must be made strongly adherent in order to obtain clear images with good contrast. To obtain this adhesion, the inferior screen, which rests upon a movable plate, at the proper moment is pressed against the fixed superior screen by means of six electromagnets arranged in two rows.

The screens are 30 cm. long; this permits the taking of roentgenograms covering a maximum of 30 by 100 cm.

Two lead sheets, arranged on the cover of the apparatus, limit the length of the exposure.

The seriograph functions automatically. The maneuvers necessary for taking the roentgenograms are regulated by an elec-

trical timer, arranged in a separate box connected to the seriograph by means of cables.

Once the patient is in place, with the vascular district to be studied well centered in the rectangle of the seriograph, the method of taking roentgenograms is as follows:

1. Begin the introduction of the radiopaque liquid by means of an injector apparatus (Dos Santos, Passler) or a hand syringe.
2. At the moment when the roentgenologist considers it an opportune time to begin the roentgenographic study, he activates the timer with a pedal. The timer consists of an asynchronous electric motor which turns a series of gears, thereby making a series of contacts which:

a. activates the pressing mechanism that squeezes the film between the two reinforcing screens;
b. sets off a volley of roentgen rays;
c. once the roentgen rays have passed, interrupts the contact that maintains the pressing apparatus in action, so that the film is once again freed;
d. frees the roller by means of an impulse which passes to the electromagnet of the stop-tooth, so that it is pulled by the spring of the other roller for the distance between two cogs, and
e. activates a counter that enables

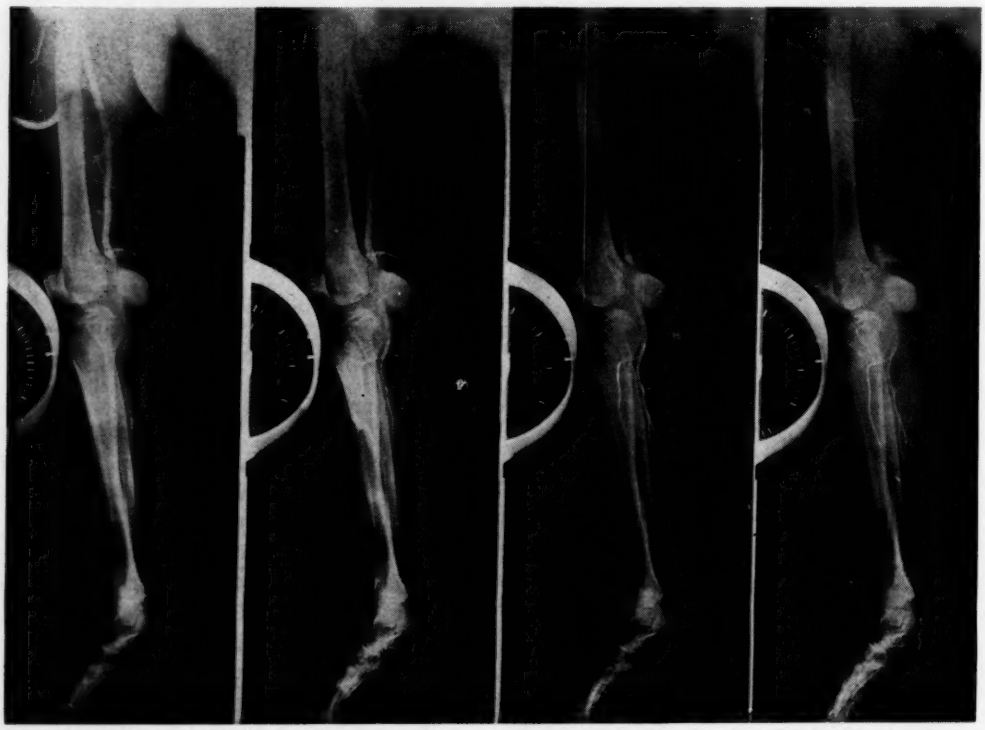

Fig. 4.—Pulsating lump in popliteal artery (exposure every three seconds), representing sacciform aneurysm of artery. Integrity of anterior contour of artery led authors to assume, preoperatively, efficacy of operation with conservation of principal hematic pathways.

the investigator to know the exact number of roentgenograms taken at any given moment.

In order to mark the chronologic progression of the single roentgenograms we use a common stop watch with a radiopaque dial, which is started with the first roentgenogram.

The rhythm of the seriographic sequence is regulated by the velocity of the circulation. In those cases in which the circulation is presumably free (arteriovenous fistula, aneurysm, tumor of soft tissue and of the skeleton, etc.) we usually take the slides at maximum velocity (0.9 second).

In cases of arterial occlusion the speed is determined from case to case on the basis of a careful estimate of the circulation through the use of the common paraclinical investigations (oscillometric test, fluorescine test, cutaneous thermometric study).

The specifications of the radiographic technic used by us, employing an ampule with a rotating anode are as follows: 60-70 kv.; 80 m.a.; D.F.H. 1.95; exposure time, three and six-tenths seconds.

These characteristics are corrected from case to case on the basis of a preliminary test roentgenographic study of the subject to be examined.

In conclusion, we maintain that the apparatus described, which we have used with complete satisfaction for the past three years, permits roentgen examination of the various phases of the filling of the arterial tree and, successively, of the venous system stem, in such a way as to provide a true angiographic picture of the limb.

The seriograms obtained correspond to the prerequisites actually required of a correct angiographic investigation: the automatic taking of roentgenograms of an entire limb in a closely timed series.

RIASSUNTO

Viene descritto un apparecchio che può riprendere automaticamente vari angiogrammi dell'intero arto in successione ritmica e ravvicinata.

ZUSAMMENFASSUNG

Die Verfasser beschreiben einen Apparat, der automatisch verschiedene Angiogramme einer ganzen Gliedmasse in kurzer rhythmischer Aufeinanderfolge anfertigen kann.

RÉSUMÉ

Les auteurs décrivent un appareil pouvant prendre automatiquement et à un rythme rapide des angiogrammes variés de tout un membre.

SUMARIO

Os AA. descrevem um aparelho que automaticamente obtem varios angiogramas de um membro inteiro em sucessão ritimica.

RESUMEN

El autor describe un aparato con el que esposible tomar automaticamente varios angiogramas de un miembro completo en una sucesión rítmica.

There is no more potent antidote to the corroding influence of mammon than the presence in the community of a body of men devoted to science.

—*Osler*

Genitourinary Surgery

Physiology of the Scrotum

Hydrocele Formation
17-Ketosteroids in Hydrocele Fluid;

JOSÉ C. FERRER, M.D., F.I.C.S.

SAN JUAN, PUERTO RICO

In a careful physiologic study of the scrotum and of the theory that this organ acts as a thermoregulator for the production of spermatozoa, the author expresses the opinion that no such regulation exists or is required.

The presence of 17-ketosteroids in hydrocele fluid, as observed in the author's cases, is analyzed, and various possible explanations are suggested. The physiologic character of the scrotum in general is discussed.

FOR years the postulate that the scrotum acts as a thermoregulator for the production of spermatozoa has been recognized as a fact, the evidence appearing in textbooks on physiology, endocrinology, gynecology and urology.

It is known that mammals and birds maintain a body temperature independent of outside temperature. Body temperature remains invariable, whether the surrounding temperature is either cooler or warmer than the body.

A relatively normal body temperature is necessary to maintain the normal biochemical index in man as in other mammals. Without this, most of the other mechanisms of regulation would be impotent, because the magnitude of the changes with which they have to contend would be increased beyond their power to handle. Through the regulation of temperature as a whole, the finer, more subtle adjustments of metabolism would be impossible.

This being the case, I have always wondered why spermatogenesis should need, for its evolutionary process, a temperature distinctly lower than the normal body temperature and why this need exists in man. Why should man, the most highly specialized creature in the universe be dependent upon this definite temperature, this air-conditioned chamber for his testis, in order to reproduce his species?

Elephants, whales and marsupials have scrotums of distinct texture, and rodents have gliding testes that move into the scrotum during nature's call for copulation. Why should women be deprived of this necessity, when in embryonic life male and female gonads develop from the same source? If the body temperature regulation depends on a common source, then the only way to decide where and why there exist variants of internal body cavities would be registration of those temperatures.

In order not to be influenced by my desire to prove how wrong I could be, I divided checking areas among independent personnel:

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1. Dr. Jack Shepard of the Presbyterian Hospital would be in charge of checking intra-abdominal temperatures in those cases in which postpartum sterilization was to be done.
2. Dr. Pedro Suau, also of the Presbyterian Hospital, would check the inguinal canals in cases of hernia.
3. Dr. Albert Mejía would check conditions inside the tunica vaginalis in cases of hydrocele.
4. I would check hydrocele and perirenal conditions, controlled with rectal temperatures Centrigrade, with Dr. Mejía.
5. The rest of the staff would study oral temperatures Fahrenheit.

This dissipates the thermoregulatory theory. Still it is obvious that high body temperatures like those observed in cases of malarial fever, typhoid, etc., will produce temporary sterility. The cell, whose characteristic symbolization of life is in its protoplasm, its ability to maintain harmoniously internally regulated chemical processes, to its response to stimuli, to reproduce itself, means life's evolution by substitution of that which wears out and with that which must become its replacement. So much is enclosed in so little with so much responsibility! The transmission of life from two persons to a succession of new ones carries along hereditary traits, since everything born must be looked upon as extending back, generation after generation, to the dawn of life.

Enzymes are protein elaborated by living cells. They are highly susceptible to variations in temperature, and it is taught[2] that most enzymes are destroyed if subjected to a temperature of 80 C or higher. The point of balance between the accelerating effect of an increase in temperature and the destructive effect of heat lies usually between 40 and 50 C but may be lower. It is, perhaps, more than a coincidence that in the mammalian organism enzymes are made to act at a temperature a little less than 40 C.

Both the testis and spermatozoa contain hyaluronidase, an enzyme derived from hyaluronic acid. It dissolves mucus-like substances and precipitates absorption from edematous areas. This hyaluronidase is supposed to dissolve the capsule of the ovum at its point of contact with the head of the sperm, thus permitting its penetration. The enzyme hyaluronidase may be the factor responsible for faulty spermatogenesis in the presence of high fever. Spermatozoa may succumb to its absorbing power, especially when, in its development, the sperm is embedded head first in the cytoplasm of the sustentacular cells, which presumably furnish their trophic supply "in normal conditions" or their venom in an altered metabolic state.

An undescended testis is an embryonic unit. If it remains incarcerated, it will be lobulated until adolescence. If it descends of its own accord during adolescence, it will not be a normal organ. If it is brought down with the aid of hormones it would have descended anyhow, hormones or no hormones, because the testis that does not descend is (a) one with too short a cord to reach the scrotum, (b) one with the cord adherent to its unnatural bed, and (c) one that is located intra-abdominally.

The theory of heredity has been loosely applied to criptorchidism, although it should have been the key to its occurrence.

The determination of sex on the basis of the presence of one chromosome that is unlike its mate and unlike any chromosomes in the opposite sex is expressed on the basis upon which the female has two x chromosomes and the male one x and one y.[1]

The female must have twenty-four pairs at miosis (23AA xxx), each ovum carrying twenty-three autosomes and one x chromosome. In the male, of the forty-eight chromosomes present at miosis in

which the homologons are visible alike and a pair consisting of members of unequal size, the larger being the x and the smaller the y chromosome (23AA + X). Two kinds of spermatozoa are formed, half of which carry an X (23AA + X) and the other half a y chromosome (23AA + Y). The sex of the offspring is determined at fertilization by the kind of spermatozoa which happens to reach and enter the egg at the time of fertilization: the X = bearing sperm produces girls and Y=bearing sperm results in boys.

The xx in the female and the xy in the male is standard for only one kind of eggs, but two kinds of spermatozoa suggest that sex has a rather simple genetic basis. As bisexuality becomes established in an involuntary line, however, the difference between the X and the Y chromosome becomes progressively greater. Selective mutations may occur influencing chromosomes which contain deleterious recessive re-ability as modifiers. It has been shown that persons heterozygous for translocation produce some spores or gametes that contain certain genes in excess and are deficient in certain others. In animals and plants, spores with such duplicative deficiencies usually abort. In animals, gametes with abnormal complements of genes do function, but the zygotes they form are aborted. "This happens in man with a high percentage of degenerated sperms for the claim of habitual abortions is based mainly on this principle." In either case, translocation heterozygotes are semisterile. Since translocations occur in the evolution of species, hybrid species are often translocation heterozygotes. This probably accounts for the sterility of some of the hybrids. In the testes of the male mule the degeneration of prospective cells begins before the stage at which the miotic pairing of chromosomes would normally take place; yet in hybrids between strains of Drosophilia, chromosomes seem to pair normally but degeneration changes set in in spite of this. Probably the parents contribute genes that interact in the hybrid in such a manner as to disturb the normal course of miosis and sex formation. Hybrid sterility caused by the genetic constitution of the hybrids, rather than by differences in gene arrangements in the paternal chromosomes, is called genetic sterility. This is perhaps the cause of sterility in strong, healthy persons who are perfectly potent and yet are condemned to suffer for their inability to enjoy the blessing of progeny.

It is also claimed of roentgen rays that not only are they capable of increasing mutations, but that an increase of temperature by 10 C more than doubles mutation frequency.[2] This favors Moore's theory, but one robin does not make a Spring!

Hereditary cryptorchidism may be caused by mutations in heterozygones.

Charny and Wolgin,[3] in a recent book on cryptorchidism, cite reports of familial influences in nondescent registered by Rhodes: "Three cases in one family." Brimble Combe reported bilateral cryptorchidism in 3 brothers; Corbus and O'Connor reported a family of 6 brothers, 4 of whom showed unilateral nondescent while the remaining 2 were bilaterally cryptorchid. Caucci observed hereditary influence twice in cases bilateral of the condition and 6 times in cases of unilateral cryptorchidism, and these authors have observed unilateral cryptorchidism in a father and his 2 sons. In each instance the anomaly was left-sided, and I have met with a father and son who both had cryptorchidism, also of the left side.

I am impressed with this data as suggestive that cryptorchidism shows strong evidence of hereditary influence. A single instance could be referred to as an incident; and 2 cases as a coincidence; but when a chain of cases beyond either incidence or coincidence is observed it becomes a matter of fixed characteristics.

I have performed intra-abdominal fixa-

TABLE 1.—*Comparative Temperatures*

	Rectal—C	*Oral—F*	*Hydrocele Sac*
Dr. Mejía	37.1		37
Hydroceles	36.9		36[5]
	36.8		36[7]
Dr. Ferrer (25 cases)		98[6]	98[6]
Hydroceles, perirenal area		99[5]	100
Dr. Suau		98[6]	98[6]
Inguinal canals		98[7]	98[6]
Dr. Shepard		98[6]	98[6]
Abdominal, postpartum, sterilization		98[6]	98[6]
Total average temperature	36.9	3 + 47 = 50	Ave 98° F

tion of the testis in rabbits. I have anchored one testis leaving the other as a control. I have closed the abdominal wound in one series and have left a rent in the peritoneal cavity in another series. I have injected 5 mg. of aqueous suspension of testosterone in one series and gynetone in another. The results have been no spermatogenesis in the anchored, normal spermatogenesis in the controls and deviated spermatogenesis in the controls when testosterone was used. That was to be expected, since depletion of spermatogenesis follows the use of testosterone before testosterone rebound takes place.

I observed that in every testis implanted into the peritoneal cavity, evidence of peritesticular inflammatory reaction had occurred. The visceral portion of the tunica was always covered with fibrinous exudate. In every case in which the testis had been sutured to the peritoneum, the testis showed a peritunical inflammatory reaction. The tunica was always covered with a fibrinous exudate. When the testis is attached to the peritoneum, the normal freedom of motion of the cord from its pivot in the testiculoscrotal ligament is prevented. The absence of the dartos and cremasteric reflexes for propulsion of venous and lymphatic drain may produce venous congestion and lymph accumulation, resulting in an inherent functional testicular deficiency. In a testicle fixed to the peritoneum the cord cannot remain perpendicular to the testis. It may assume any shape whatever. When the testis is sutured to the peritoneum its blood supply has been tampered with, because its main artery, the spermatic, coming from the aorta, has to alter its perpendicular course to take an inverted U shape, since its normal length—that required to reach a scrotal testis—has been shortened by the distance between the base of the scrotum and the internal ring.[4] There is no question that the normal location of the testis is the scrotum. In it there are two main layers of major importance, the dartos and the cremasteric, and one unnoticed layer, "Cooper's fascia," to which I shall refer later.

In the dartos there are elastic fibers, connective tissue and smooth muscle fibers, placed at right angles with the derma. It is extremely vascular, free of fat and continuous at the subcutaneous inguinal ring with the intercrural fibers, being probably the scrotal representative of the external oblique muscle.

It is succeeded by a strong sheet of fascia containing longitudinal bands of striated muscle tissue forming what is called the cremasteric muscle, and contin-

uous above with the fibers of the internal oblique muscle of the abdomen.[6]

In the blond, the scrotum is tighter and smaller than in the dark-skinned person, and in cold weather the scrotum contracts, perhaps acting as an overcoat to conserve the normal body temperature of the organ.

A reflex stimulus of the dartos commences at its most pendulous portion. A series of contractile primary waves meets a descending lateral wave. When these two forces unite, the scrotum contracts rapidly from within and upward to join a now cremasteric stimulus that raises the testis from within forward and upward in the direction of the external ring. At this point there is a pause; then relaxation starts slowly downward and continues until the normal original shape is resumed. If one tries to create this dual reflex, one will be able to obtain an immediate response. No response will be obtained, however, by either stimulating the skin of the leg or by pulling at its base, after the original reflex is completed. One must wait for a few long seconds to obtain another reflex cycle.

If the subject is asked to urinate before the reflex is provoked a normal sediment will be obtained if the subject is normal, but, if one can stimulate the reflex four or five times and have the subject urinate, one may "sometimes, not always" discover spermatozoa in the urine, a phenomenon that has been reported by many authors.

In the rodents, the testis descends into their scrotum when in copulation. The reason? The scrotum contracts tightly against the inguinal canal at the act of copulation; the perineal muscles and the abdominal muscles contract together; the cremasteric muscle is continued with the fibers of the internal oblique and the dartos with the external oblique. Spermatozoa lie packed in the epididymis, and I am convinced that the complete cycle of muscular contraction is effective in expelling spermatozoa from the epididymis for their mixing with the now complete seminal fluid.

The scrotum is a pendulous and vascular organ, with a vast net of lymphatic vessels. The venous blood and lymph must be kept in continuous movement or lymph edema and venous congestion will take place. In the extremities, venous and lymphatic circulation are activated by muscular movement. The scrotum has no muscular movements except its reflexes. It is to be expected, therefore, that, even as there are no continued marked reflexes, there exists a certain degree of muscular contraction and relaxation among the many rugae for venous and lymphatic fluid propulsion.

All these muscular reflexes produce mechanical energy, which obviously means the creation of heat. The scrotum faces the leg and the fold of the leg and scrotum registers a temperature equal with that of the axilla; as a matter of fact, European physicians chose the axilla as the site of temperature-taking in cases of fever, and also the fold of the leg, especially in children. I am not going to discuss heat conveyed by radiation, conduction and convection, but it is obvious that the area between the leg and the scrotum is in opposition to the supposedly low temperature of the scrotum, whatever is meant by that.

The island of Puerto Rico is known for its thickly settled population per square mile. There is an exceedingly high incidence of hydroceles in the male. A tunical sac filled with hydrocele fluid cannot lower the temperature of the testis, for two reasons: first, close cavities *per se* are insulations, and second, a close cavity filled with any kind of fluid becomes a double insulator, and the tunica vaginalis, being derived from the peritoneum is an insulator.

I have operated in more than 3,000 cases of hydrocele. Many of the patients were married men who had had hydrocele long

before they were married and had reared a good-sized family without any action of the scrotal thermoregulator as such.

Since the publications of Moore and his associates, I have become aware from the symptoms, signs and post-treatment results in patients with pathological conditions involving the scrotum and the enclosed organs further investigation would clarify my point of view. My first thoughts were directed towards hydrocele because, assuming Moore to be correct, the necessary inference was that patients with bilateral hydrocele should be deprived of the power of procreation. I had noticed that, in cases of acute epididymitis in which the head was mainly involved, the disease was always complicated by an acute hydrocele in which the skin of the scrotum became tense and shiny and its base showed definite edema that pitted on pressure. I recalled that in Testut's Anatomy,[5] in the description of Cooper's fascia, the fact is mentioned that between the meshes of its muscular fibers filtration of the noxious products from the testicle took place, and that the author reinforced this statement by citing the fact that in postmortem decomposition gas accumulates in this area. If this is true, the absorbing power of the tunica vaginalis can be blocked; fluid can accumulate progressively either in response to an irritating factor obstructing the pathway of filtration within the tunica or because of obstruction to the absorbing power of the tissues around the tunica parietalis.

I tested these theories, therefore, first from without inward and then from within outward. I injected (intradermally) 2 cc. of 0.8 per cent solution of indigo carmine into the scrotum in patients prepared for hydrocele operation, and waited for fifteen minutes after the injection before the operation was commenced. Following the course of the incision, I noticed that all the layers of the scrotum were stained but that the external aspect of the tunica was not. Hydrocele fluid had not been stained. I repeated the experiment on 12 patients with unaltered results. As fluorescence is so penetrating, I tried the experiment with a fluorescent dye. The galvanometer was set at zero. When a fluorescent solution was introduced into the tube, with use of 0.1 mg. fluorescence control, the following results were obtained:

TABLE 2.—*Data on 17-Ketosteroids in Hydrocele Fluid*

Name	*Age*	*Amount, Cc.*	*Equivalent, Mg.*	*17-Ketosteroids, per Cc.*	*Per 100*	*Per 1,000*	*Per 1,500*	
A. E.	59	57	0.110	0.00195	0.195	1.95	2.925	
V. G.	64	55	0.1226	0.0022	0.22	2.2	3.3	
H. L.	55	70	0.196	0.0028	0.28	2.8	3.2	
H. S.	34	46	0.162	0.00373	0.373	3.75	5.59	
S. R.	37	50	0.190	0.0038	0.38	3.8	5.70	
V. Q.	46	48	0.1615	0.00336	0.336	3.36	5.04	
J. R.	49	48	0.1715	0.0035	0.35	3.5	5.25	
J. R. C.	58	41	0.144	0.00351	0.351	3.51	5.26	
F. P.	26	51	0.73	0.0045	0.45	4.5	6.75	
R. B.	25	41	0.210	0.0051	0.51	0.51	7.65	
							Total	Average
Average	45	50.7	0.16976	0.03324	.33245	3.4447	50.665	5.06

Control	11
First	13
Second	13
17 ml. of the second liquid plus 0.1 mg. fluorescent solution	25

Then, in selected cases I reversed the experiment. I aspirated about 10 cc. of fluid and instructed the patient to rest for one hour. Then, using a 28 gage needle, I injected 1 cc. of 0.8 per cent solution of indigo carmine. Again I waited for fifteen minutes before operating. The stain had traversed the tunica, not in pyramidal form from the point of injection but spreading in all directions, not heavily but noticeably. Since filtration had been hampered by heavy molecules in the hydrocele fluid and by withdrawal of 10 cc. of the fluid I had released internal pressure within the cavity, the stain was capable of slow but sure transfusion.

I rechecked the compositional values of hydrocele fluid. I took 50 samples from persons ranging in age from 1½ years to 70. In the youngest group, aged from 1½ to 3 years, the specific gravity was lower; a trace of sugar was found, but the protein index was not altered. In the adult the specific gravity was 1023. All of the patients were studied for microfilaria in the blood smear. Two cases were interesting.

Case 1.—A. C. was admitted to the Municipal Hospital, on Dec. 17, 1943. Tests for microfilaria in the blood stream gave positive results. The patient had never had a filarial attack, and there was no relevant pathologic change except the hydrocele, which was typically acute, on the left side. No dartos or cremasteric reflex could be evoked, but although a congestive process was unmistakably present, as shown by the tension of the scrotal skin and the feeling of rise in temperature, the patient had no pain and not the slightest discomfort except for the tumor mass that had developed within forty-eight hours.

When the tunica was opened, an olive-green fluid was obtained, much deeper than in some of the cases I had observed before. There was no bacterial growth, and the only explanation I could offer for the discoloration was the large number of cholesterol crystals adherent to the tunica. No microfilaria were observed within the fluid.

Case 2.—A. G., a 20-year-old mulatto, was admitted to the Municipal hospital to be operated on for hydrocele. Tests of the blood revealed microfilaria. There was a nodule in the course of the anterior set of veins, obviously a filarial nest. The amount of fluid in the tunical cavity was more than 10 cc. Some nodulations were adherent to the tunica. They were concretions of cholesterol crystals lined with a gelatinous substance. The body of the epididymis was fibrotic, with bands of adhesions, some tight enough to make the body a lobulated tubule. Microfilaria were present on the left side; transparency was nil. On incision of the skin, bleeding was profuse and was checked by hot packs. The parietalis was not thickened but the biceralis was hyalinized, dully whitish with patches of localized hemorrhage. Cholesterol crystals were abundant, adherent mainly to the area of the globus major, with pockets from individual independent scar tissue formation. The color of the fluid was milky, and there were numerous microfilaria.

I accepted the transmigration of microfilaria through a broken lymphatic channel permeating the tunica, but how could I explain the presence of spermatozoa in hydrocele fluid as cited by several authors and confirmed by myself? Was there any possibility of a connection, somehow, somewhere, between the testis or the epididymis and the cavity of the tunica?

Again I had to refer to a former encounter: "In every case of epididymitis, when the head of the epididymis becomes involved, the epididymitis is accompanied by an acute hydrocele. This does not take place when the tail and body alone become inflamed." The place to search for this possibility, then, would be the site of union of the globus major and the body, and from the posterior aspect, because anterolaterally there are folds of tunical tissue uniting the head and the testis. I did several sections of testes from cadavers and discovered a series of canals, lined with mesothelial cells. The mesothelium is formed by the development of sacs from

the archentoron, which becomes separated by constriction to form close cavities. The tunica vaginalis normally forms a close cavity and is derived from the peritoneum, which is also a close cavity.

At the fusion of the tunica with the testis and the globus major, the tunica covers the cord for a distance of about 10 mm. From there on the cord is an independent structure. When the tunica covers this sector of the cord, however, the visceral layer is separated from the parietal, forming a perfect U between the cord and the testis. Can this be the area through which filtration is possible? Then Testut's description of Cooper's fascia and the possibility of filtration through its meshes is confirmed.

What next? If there is filtration or diffusion, is it not possible that metabolized hormones may be present in hydrocele fluid?

I gathered fluid from hydroceles in men of different ages. Dr. Carmen Casas and Mrs. María García of our School of Tropical Medicine made tests for 17-ketosteroids and found amounts higher, in cubic centimeter, than the proportion used by them and the 1,500 cc. average of urine excreted in twenty-four hours. Again there is a serious problem to deal with, and it will take time to clear this problem, with God's help, to my absolute satisfaction.

CONCLUSIONS

A thorough study of the theory of scrotal thermoregulatory ability has been made. As the only possible scrotal area that fits this theory would have to be the cavity or through the cavity of the tunica vaginalis, the author is convinced that he has proved this to be impossible.

The following further conclusions are made:

That men with large bilateral hydroceles since early manhood have married and have proved perfectly virile.

That an undescended testis, if brought down before adolescence, will be useless. It may be compared to a drone which has no sting and produces no honey.

That an undescended testis is a testis deprived of its normal blood and lymphatic circulation.

That in the presence of high fever, the action of the enzyme hyaluronidase may destroy spermatozoa temporarily.

That experiments carried out in rabbits by fixing the testis into the abdominal wall yield results that confirm those of other investigators.

That internal body temperature is normally constant and equal in body cavities.

That a series of canals is present in the posterior area where the globus major is continued with the body of the epididymis.

That 17-ketosteroids are present in hydrocele fluids in amounts higher in comparable percentages of the fluid in proportion to the average amount of urine excreted in twenty-four hours.

Registration of the temperature has been done in the cases of human subjects but not in those of experimental animals.

The physiologic nature of the scrotum is discussed.

Author's Note: I wish to express my gratitude to Dr. Carmen Casas and Mrs. María García for their aid in performing the tests for 17-ketosteroids; to Dr. José Taveras for his aid in search of the canals by serial sections done by him; to Dr. Alberto Mejía, Dr. Pedro Suau and Dr. J. Shepard for their aid in recording temperatures in the cavities of their patients; to Mr. Antonio Puras for preparing the slides, and to Bitin Gutiérrez, a first-year medical student, for helping with the animal experiments.

CONCLUSIONI

E' stato compiuto uno studio accurato sul supposto potere termoregolatore dello scroto. Tale potere dovrebbe essere attribuito alla cavità vaginale, ma l'autore non crede a questa ipotesi.

Egli giunge alle seguenti conclusioni:

— Che uomini affetti fin dall'adole-

scenza da grandi idroceli bilaterali possono sposarsi e procreare.

— Che testicoli ritenuti e fatti discendere prima della adolescenza sono inutili funzionalmente.

— Che i testicoli ritenuti sono testicoli sprovvisti di una normale circolazione sanguigna e linfatica.

— Che la ialuronidasi, in soggetti con febbre alta, può distruggere temporaneamente gli spermatozoi.

— Che la fissazione dei testicoli dei conigli nella parete addominale porta a risultati che confermano quelli di altri ricercatori.

— Che la temperatura interna del corpo è di regola costante e uguale in tutte le cavità corporee.

— Che nel liquido di idrocele sono presenti alte quantità di 17-chetosteroidi.

Le registrazioni della temperatura sono state esse guite sui soggetti umani e non sugli animali da esperimento.

CONCLUSIONS

L'auteur s'est livré à une étude sur la théorie du pouvoir thermorégulateur du scrotum. Comme la seule région scrotale cadrant avec cette théorie devrait être la cavité ou la tunique vaginale, l'auteur pense avoir réussi à prouver son impossibilité, et aboutit aux conclusions suivantes:

Des hommes atteints de grandes hydrocèles bilatérales depuis leur adolescence se sont mariés et se sont révélés viriles.

Un testicule non descendu deviendra inutile s'il est descendu avant l'adolescence, et peut être comparé à un faux-bourdon n'ayant pas d'aiguillon et ne produisant pas de miel.

Un testicule non descendu est un testicule privé de sa circulation sanguine et lymphatique normale.

En cas de fièvre élevée l'action de l'hyaroludinase enzymatique peut détruire temporairement les spermatozoïdes.

La fixation du testicule dans la paroi abdominale chez le lapin donne des résultats confirmant ceux d'autres recherches.

La température du corps est normalement constante et égale dans toutes les cavités physiologiques.

Il existe une série de canaux dans la région postérieure, là où le globus major se continue avec le corps de l'épididyme.

Les 17 kétostéroïdes sont présents dans le liquide de l'hydrocèle en quantité supérieure comparativement à la quantité moyenne de présence dans l'urine excrétée en 24 heures.

La température a été mesurée chez l'homme, mais non chez les animaux en expérience.

La nature physiologique du scrotum est discutée.

SCHLUSSFOLGERUNGEN

Es liegt eine sorgfältige Untersuchung der Theorie der wärmeregulierenden Fähigkeit des Skrotums vor. Diese Theorie wäre nur auf die Hodenhöhle oder auf die Tunica vaginalis anwendbar, und der Verfasser glaubt nachgewiesen zu haben, dass diese Möglichkeit nicht besteht.

Er kommt ferner zu folgenden Schlussfolgerungen:

Männer, die seit ihrer Jugend an einer doppelseitigen Hydrozele litten, haben geheiratet und sich als völlig mannbar erwiesen.

Ein nicht herabgestiegener Hoden, der vor der Pubertät in den Hodensack heruntergebracht wird, ist nutzlos. Er lässt sich mit einer Drohne vergleichen, die weder einen Stachel hat noch Honig produziert.

Ein nicht herabgestiegener Hoden hat keinen normalen Blut- und Lymphkreislauf.

Das Enzym Hyaluronidase kann bei hohem Fieber die Spermatozoen zeitweilig zerstören.

An Kaninchen ausgeführte Versuche mit Fixierung des Hodens in die Bauch-

wand haben die Ergebnisse anderer Forscher bestätigt.

Die innere Körpertemperatur ist normalerweise konstant und in allen Körperhöhlen gleich.

In der hinteren Gegend des Hodensakkes, wo der Kopf in den Körper des Nebenhodens übergeht, gibt es eine Reihe von Kanälen.

Die Flüssigkeit der Hydrozele enthält einen höheren Prozentsatz an Geschlechtshormonen (17-Ketosteroide) als der Durchschnitt der in 24 Stunden ausgeschiedenen Harnmenge.

Aufzeichnungen der Temperaturen erfolgten am Menschen aber nicht an Versuchstieren.

Die Physiologie des Skrotums wird besprochen.

CONCLUSIONES

Se hace en este trabajo un estudio completo sobre la teoría de la capacidad termoreguladora del escroto.

Ya que la única zona posible que va bien a esta teoría correspondería a la túnica vaginal el autor está convencido de que no es suficiente para tener ningún valor.

De su estudio saco el autor las siguientes conclusiones:

Los hombres con hidrocele bilateral desde su juventud son perfectamente viriles.

Los testes ectópicos, si se hacen descender antes de la adolescencia, son inútiles. Los compara el autor a zánganos que ni tienen aguijón ni producen miel.

Los testes ectópicos están desprovistos de su circulación sanguínea y linfática normal.

Las experiencias llevadas a cabo en conejos a los que se fijan los testes dentro de la cavidad abdominal dan resultados que confirman las de otros investigadores.

La temperatura interma del organismo es constantemente normal en todas las cavidades.

Existe una serie de canales en el área posterior donde el globus major se continúa con el cuerpo del epidídimo.

En el líquido del hidrocele existen 17-cetosteroides en cantidades mucho mayores en proporción a los que se encuentran en la orina de 24 horas.

Se han hecho comprobaciones de temperatura en casos de sujetos humanos pero no en animales de experimentación.

También se trata de la importancia psicológica del escroto.

CONCLUSOES

Um estudo extenso da teoria da capacidade termo reguladora escrotal foi realizado. A única área escrotal capaz de enquadrar-se com esta teoria seria que ser a cavidade ou através a cavidade da túnica vaginalis. O autor está convencido ter provado a impossibilidade desta teoria.

Outras conclusões chegadas são as seguintes: Homens com hidroceles bilaterais volumosas desde o principio da vida adulta, casaram-se e provaram ser perfeiramente virís.

Quando a ectopia testicular é corrigida antes da adolescencia, o testiculo não terá função; que um testiculo ectópico é um testículo deprivado de circulacão sanguinea e linfática normal.

Que na presenca de febre elevada a ação do enzima hialuronidase pode temporàriamente destruir espermatozoides.

Os experimentos levados a cabo em coelhos, fixando os testículos na parede abdominal, revelaram resultados que confirmam àqueles de outros investigadores.

Que a temperatura corporal interna é em condições normais igual e constante ao das cavidades corporais.

Uma série de canais está presente na área posterior aonde o globus maior continua-se com o corpo do epidídimo.

O registro de temperaturas só foi obtido dos casos humanos não tendo aquelas dos animais de experimentação sido registradas.

A natureza fisiológica do escroto é discutida.

REFERENCES

Charney, C. W., and Wolgin, W.: Cryptorchidism. New York: Paul B. Hoeber, Inc., 1957, p. 21.

Fulton, J. F.: A Textbook of Physiology. Philadelphia: The W. B. Saunders Company, 1955, pp. 971-972.

Morris: A Treatise on Anatomy. Part 4, p. 1254.

Testut, L.: Tratado de Anatomia Humana. Vol. 4, p. 714.

Sinnott, F. W., Dunn, L. C., and Dobzhansky, T.: Principles of Genetics. New York: McGraw-Hill Book Company, Inc., 1950, pp. 175-193.

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Pneumoencephalographic Study with Helium and with Minimal Withdrawal of Cerebrospinal Fluid

JOSÈ ANTONIO RODRIGUES, M.D.*

AND

JOSÈ GERALDO ALBERNAZ, M.D., F.A.C.S., F.I.C.S.**

BELO HORIZONTE, BRAZIL

Tolerance of pneumoencephalographic procedures done without removal of cerebrospinal fluid and with helium used as the contrast medium is the topic here discussed. The available literature is reviewed. Thirty-five patients were observed, and the results are presented, with the following conclusions:

1. The patient's reactions to pneumoencephalographic study when no spinal fluid is removed and helium is used as contrast medium are usually of short duration and not severe.

2. As a result, the patients usually cooperate well and rarely require postoperative medication. Ordinarily, too, they need be hospitalized only for short periods.

PNEUMOENCEPHALOGRAPHIC investigation, a valuable diagnostic procedure for the neurologist and neurosurgeon, is still considered a source of great discomfort to the patient.

Since Dandy's original work,[1] modifications of the technic of pneumoencephalography have often been proposed. Details pertinent to preoperative medication, anesthesia, positioning of the patient, amount of cerebrospinal fluid removed, type of gas used, postoperative care, etc., have been studied by many different workers, who have endeavored to make pneumoencephalographic examination simple and well tolerated.

Hence comes our interest in selecting a pneumoencephalographic technic that would cause the least possible inconveniences to the patient. For the time being, we have decided to limit our study to two important factors that have been less frequently investigated: the type of gas injected and the amount of fluid removed.

1. *Type of Gas Injected.*—In 1922, Bingel[2] suggested the use of carbon dioxide, which, after introduction into the subarachnoid spaces, is more quickly absorbed than air. Jungling,[3] for the same reason, recommended oxygen. Liberson,[4] using the technic of simultaneous substitution of air for cerebrospinal fluid, suspected that impurities in the atmospheric air would be partly responsible for the patient's severe reactions. Thus, he injected water-filtered air in to 115 patients

*Assistant in Clinical Neurology, School of Medicine of the University of Minas Gerais, Belo Horizonte.

**Acting Professor of Clinical Neurology.

Read at the First International Congress of Neurological Surgery, Brussels, July 21-28, 1957.

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and nonfiltered air into 40; he arrived at the conclusion that the immediate headaches were identical in the two groups but that the secondary reactions were lighter in those cases in which filtered air had been injected. Trying to find a less irritating gas, he used carbon dioxide, but soon abandoned it because of its high solubility in the spinal fluid. It was his opinion that reactions to nitrogen were only slightly lighter than reactions to air; after using water-filtered helium in 12 cases, he reported less severe reactions than with any other gas he had tried.

Newman[5] studied 8 cases of pneumoencephalographic study with nitrous oxide: the radiologic results were poor, owing to the high rate of absorption of this gas from the subarachnoid spaces; the immediate reactions were similar to those induced by air; there was no evidence of anesthesia or sedation, but in the author's opinion the secondary reactions were greatly diminished. He also tried ethylene in 28 cases, with similar results. He mentioned lowering of the hospitalization period from three days (with air) to one and eighty-five hundredths days (with ethylene).

Aird[6a] also tried both, nitrous oxide and ethylene. He confirmed the rapid absorption of nitrous oxide, resulting in poor roentgen pictures, and recommended the use of ethylene as less irritating than air and capable of limiting the secondary reactions to an average duration of thirty hours. One year later, however, the same author[6b] reported on 164 patients submitted to ethylene pneumoencephalographic study, with an incidence of 20 per cent of severe reactions.

In 1942, Cleveland and End[7] studied helium as a contrast medium and oxygen for postoperative inhalation in pneumoencephalographic examination; they reported highly satisfactory results. According to these authors, the relief of symptoms is related to the disappearance of the gas from the subarachnoid spaces. As it is not feasible to aspirate it back, it must leave through the stream and the lungs. The rate of transference of the gas from the subarachnoid spaces, through the capillary blood vessels to the stream varies with certain physical factors, as is pointed out by the authors: (1) difference of concentrations of the injected gas in the subarachnoid spaces and in the blood, and (2) diffusibility of the gas. The diffusibility of a gas is related to the size of its molecule; light gases, made up of small molecules, become diffused more rapidly than do heavier ones. As stated by Graham's law, the index of diffusibility of a gas is inversely proportional to the square root of its molecular weight. Thus, helium, nitrogen and oxygen, with molecular weights of 4, 28 and 32, have a diffusibility rate inversely proportional to 2, 5.3 and 5.7, respectively. In other words, the speed of diffusibility of helium is almost three times that of nitrogen or oxygen. Hydrogen, the only other gas more diffusible than helium, would have, for pneumoencephalographic purposes, the disadvantage of being combustible. Roentgen pictures, taken repeatedly at different intervals, demonstrate the greater speed of absorption of helium from the subarachnoid spaces, as compared to oxygen or air. Once a gas is introduced into the subarachnoid spaces, there will be exchange of gases between these spaces and the blood. If air is used, its oxygen is readily absorbed by the capillary blood, but other gases such as nitrogen and carbon dioxide, pass from the blood to the subarachnoid spaces, until a certain equilibrium is established. There will be a complex mixture of the gases, with slow absorption. When the patient breathes pure oxygen, instead of plain air, the carbon dioxide and the nitrogen from the blood are more promptly removed at the pulmonary alveoli, which prevents, in part, the diffusion of these gases toward the

subarachnoid spaces. There are therefore two factors favoring the use of helium in pneumoencephalographic studies: the rate of diffusion and the lack of helium in the blood.

Davidoff and Dyke,[8] comparing different gases for this purpose, concluded that oxygen is less irritating than air and that helium is even less irritating than oxygen.

Grinker and Bucy[9] also prefer helium; they advise 55 to 60 cc. of helium to be exchanged with a similar amount of spinal fluid and report of pronounced decrease in postoperative headaches, nausea and vomiting, as well as perfect tolerance of the examination with no need of general anesthesia.

We have therefore selected helium as the gas of choice for pneumoencephalographic procedures and have used it for several years, following essentially the technic described by Grinker and Bucy.[9]

2. *Amount of Spinal Fluid Removed.*—Kasahara,[10] after experimental studies in rabbits, stated that transitory irritation of the meninges results from removal of large quantities of spinal fluid.

Petersen[11] has reported a decrease in spinal fluid pressure after pneumoencephalographic study, and, as a result, has advised that the quantity of air injected be greater than that of the fluid removed.

Epstein and Von Storch[12] have expressed the opinion that removal of spinal fluid leaves the brain unprotected against shocks; distortion and friction of the encephalic substances against the skull could be the cause of increased pain resulting from movements of the head.

Slosberg, Bornstein and Lichtenstein[13] have admitted that many of the reactions following pneumoencephalographic study are due to the removal of spinal fluid, as a simple lumbar puncture frequently causes some reaction. They have performed pneumoencephalographic examination without any removal of spinal fluid, using air in variable amounts, as necessary, to provide the desired filling of the ventricles and/or the subarachnoid spaces. After trying this procedure in 35 cases, they reported excellent tolerance: twenty-four hours after the examination there were no patients complaining of headache.

Slosberg[14] has recently compared the results of 65 pneumoencephalographic examinations done without spinal fluid removal with those of 20 cases with removal; reactions were less severe in the first group. He is convinced that most lipotimias observed when his technic is used may be due to rapid introduction of air into the subarachnoid spaces and recommends, as a rate of injection, only 8 cc. of air per minute.

These studies on the effects of removal of large amounts of spinal fluid, and particularly the satisfactory results reported by Slosberg, Bornstein and Lichtenstein,[13] have prompted us to accept a technic that can be employed without removal of cerebrospinal fluid and to employ as a contrast medium.

Material and Methods.—This is based on observations of 35 patients, most of them with convulsive disorders, examined pneumoencephalographically in our services from Jan. 1, 1956 to Feb. 5, 1957. Helium was injected by the lumbar route, without removal of spinal fluid or with removal of a minimal amount. In the cases in which some fluid was removed, the amount was limited to 10 cc. at most, and was observed for laboratory studies.

The series included 25 male and 10 female patients. There were 9 children and 26 adults, their ages ranging from 4 to 70 years; 29 were white and 6 were Negro; 2 were Portuguese, and 33 were Brazilians.

According to our plan of work, all met the following requirements: (1) use of local anesthesia; (2) no increase in spinal fluid pressure; (3) no removal of spinal fluid, or removal of a minimal amount;

(4) the use of helium gas used as the only contrast medium, and (5) no administration of oxygen in the postoperative period.

The technic used was as follows:

1. *Preoperative Care:* Most patients were admitted to the hospital on the morning of the examination, without breakfast. Adults were given, one hour before the gas injection, one capsule (100 mg.) of Nembutal; this was followed, in half hour, by 1 ampule of Dilaudid-Scopolamin (0.002 gr. of dihidromorphinone chlorohidrate and 0.0003 gr. of scopolamine chlorohidrate), administered intramuscularly. For children these doses were appropriately decreased. In rare instances other drugs were used for premedication; however, they were always barbiturates given by mouth and opiates with scopolamine or atropine given parenterally.

2. *Puncture Technic:* With the patient sitting on a special chair, provided with a comfortable headrest, having his head flexed in intermediate position and his vertebral column slightly flexed, the fourth lumbar interspace was entered with a No. 20 lumbar puncture needle, after the usual antiseptic precautions and the intradermic infiltration of 1 per cent procaine hydrochloride.

3. *Manometric Study:* Spinal fluid pressure was measured with a water manometer of the Ayer type. We considered normal all levels that did not go higher than the probable level of the fluid inside the ventricles. Then, in some cases, up to 10 cc. of fluid was removed for laboratory studies; in the other cases only a few drops of fluid were lost with the pressure readings.

4. *Introduction of Gas:* Filtered through boiled water, at a temperature of 37 C, helium was injected in amounts of 10 cc. each thirty seconds, up to 50 cc.; a few patients were given as little as 40 cc. and others as much as 80 cc. of helium.

5. *Immediate Postpuncture Care:* After the gas injection and removal of the needle, the patient was taken to the roentgen department, and as many plates were obtained as seemed necessary; frequent changes of his position on the roentgen table were in many instances needed. After the examination he was allowed to rest, lying on his back, with the head elevated about 30 degrees. No oxygen was used. The patient was carefully observed and his complaints noted. Analgesics were used as needed.

Results.—The accompanying table summarizes some data on these patients, such as age, sex, race, amount of spinal fluid removed, amount of helium injected, filling of the ventricles, cooperation of the patient during the examination, need of postoperative medication and duration, in hours, of the hospitalization required.

The patient's reactions will be analyzed in greater detail.

1. *Immediate Reactions:* We consider *immediate* those reactions which accompanied introduction of the gas and persisted during the procedure.

Headaches were considered severe when the patient complained much or became restless and unable to cooperate well with the examiners. They were called light when the patient described them as such and cooperated satisfactorily with the entire procedure. We registered absence of headache only when the patient denied having any even after we had told him he should expect it.

Vomiting and lipotimia were analyzed according to their frequency.

Sweating was called intense when generalized and light when present only in the face and/or the hands.

Convulsions were observed and described according to clinical type.

2. *Late Reactions:* We consider those reactions late that continued or appeared

Data on 35 Cases

Case	Age of Patient	Sex of Patient	Race of patient	Fluid Removed, cc.	Helium Injected cc.	Ventricular Filling	Patient's Cooperation	Postoperative Medication	Hospitalization, Hours
1	26	F	W	—	50	Good	Fair	No	24
2	53	M	W	10	50	Good	Good	No	24
3	11	F	W	—	40	Good	Good	No	24
4	14	M	C	10	50	Good	Good	Yes	24
5	42	M	W	—	50	Good	Good	No	24
6	16	F	W	—	50	Good	Good	Yes	24
7	44	M	W	10	50	Good	Poor	No	24
8	70	M	W	10	60	Good	Good	No	24
9	11	M	C	10	50	Good	Good	No	24
10	33	M	W	10	50	Good	Good	No	24
11	39	M	W	10	50	Good	Poor	Yes	48
12	23	M	W	10	50	Good	Good	No	24
13	32	F	C	10	50	None	Good	No	24
14	46	M	C	10	50	Good	Good	No	24
15	14	F	W	10	50	Good	Fair	No	24
16	35	F	W	—	50	Good	Good	No	24
17	38	M	W	—	50	Good	Fair	Yes	48
18	27	M	W	10	50	Good	Good	No	24
19	4	F	W	10	40	None	Fair	No	24
20	53	M	W	—	80	Good	Good	No	10
21	14	F	W	—	60	Good	Fair	Yes	24
22	29	M	W	10	50	Good	Fair	Yes	24
23	11	M	W	10	50	Good	Poor	No	24
24	16	M	W	10	50	Good	Good	No	24
25	67	M	W	10	50	Fair	Fair	No	24
26	27	F	W	10	50	Good	Good	No	24
27	57	M	W	10	50	Good	Fair	Yes	24
28	19	M	W	10	50	Good	Good	No	24
29	16	M	C	—	50	None	Good	No	24
30	13	M	W	—	50	Good	Good	Yes	24
31	16	M	W	10	50	Good	Good	No	24
32	44	M	W	—	50	Good	Good	No	10
33	38	M	W	—	50	Good	Fair	Yes	48
34	13	M	W	10	50	Fair	Good	No	24
35	16	F	C	—	50	Good	Fair	No	24

after the roentgenographs were taken, that is, after the patient had been allowed to rest.

We noted the severity of the headaches and their duration in hours; of course, this is only approximate, since it would be difficult for the patient to state precisely the moment when the headache ceased.

Vomiting, again, was considered according to its frequency.

We distinguished between light and intense drowsiness according to the patient's delay in responding to external stimuli and his readiness to return to sleep when the stimuli were discontinued.

The immediate and the late reactions may be summarized as follows:

Immediate

1. Headache:
   Severe: 13 cases in 35 (37.1 per cent)
   Light: 18 cases in 35 (51 per cent)
   Not present: 4 cases in 35 (11.4 per cent)

In a satisfactory number of cases there was only light headache or none at all.

2. Vomiting:
   Frequent: 1 case in 35 (2.8 per cent)
   Rare: 5 cases in 35 (14.2 per cent)
   Not present: 29 cases in 35 (82.8 per cent)

In the great majority of the cases vomiting did not occur; it was frequent only in 1 case.

3. Lipotimia:
   Not present: 29 cases in 35 (82.8 per cent)
4. Convulsions:
   Clonic generalized: 1 case in 35 (2.8 per cent)
   Jacksonian: 2 cases in 35 (5.7 per cent)

Lipotimia and convulsions were present in few cases.

5. Sweating:
   Intense: none
   Light: 2 cases in 35 (5.7 per cent)
   Not present: 33 cases in 35 (94.3 per cent)

This was a very small incidence of sweating; when present, it was never intense.

Late

1. Headache
   Severe: none
   Light:
   (a) duration up to six hours: 12 cases in 35 (34.2 per cent)
   (b) duration up to twelve hours: 9 cases in 35 (25.7 per cent)
   (c) duration up to twenty-four hours: 7 cases in 35 (20 per cent)
   (d) duration up to forty-eight hours: 1 case in 35 (2.8 per cent)
   Not present: 6 cases in 35 (17.1 per cent)

The percentages of patients without late headaches and with headaches of short duration were satisfactory. It should be pointed out that no patient complained of severe headache.

2. Vomiting:
   Frequent: none
   Rare: 4 cases in 35 (11.4 per cent)
   Not present: 31 cases in 35 (88.6 per cent)

In short, vomiting, as a late reaction, did not cause any concern.

3. Drowsiness:
   Intense: 8 cases in 35 (22.8 per cent)
   Light: 17 cases in 35 (48.5 per cent)
   Not present: 10 cases in 35 (28.5 per cent)

Drowsiness was observed in 71.5 per cent of the cases, but it should not be forgotten that the patients had been given barbiturates and opiates prior to the examination.

COMMENT

Almost everyone writing on pneumoencephalography has referred to headaches of immediate onset and variable duration.

Using atmospheric air, Hagenau,[15] Friedman, Snow and Kasanin,[16] Pancoast and Fay,[17] Solomon and Epstein,[18] Vincent, Rappoport and Berdet,[19] Liberson,[4] Bohn,[20] Schwab, Fine and Mixter,[21] Brain,[22] Delay, Soulairac and Desclaux,[23] Nielsen,[24] Kornreich,[25] and Trowbridge, Bayless and French[26] reported headache of one to five days' duration. Longer periods were reported by Schott and Eitel[27] (twelve days); Buchanan[28] (fourteen days); Aird[6a] (seven to ten days); Newman[5] (twenty-one days); Marotta and Bustos[29] (three to ten days), and Turner

and Brody[30] (two months and seven days).

We have already mentioned several authors who have recommended the use of oxygen as contrast medium. Casamajor, Laiplan and Kozinn,[31] working with children, reported fewer reactions with this gas than with air.

Good results with helium were reported by Liberson[4] and by Grinker and Bucy.[9] Cleveland and End[7] observed, in patients in whose cases helium was used and no oxygen was given postoperatively, an average of eighteen hours' duration of the symptoms. Davidoff and Dyke[8] reported headaches lasting from one to five days with helium pneumoencephalographic study; they further stated that oxygen is less irritating than air and helium less irritating than oxygen. On the other hand, Trowbridge, Bayless and French[26] observed no significant difference in the results of using helium as those of using air.

Slosberg, Bornstein and Lichtenstein[13] encountered few reactions with the use of air, when the pneumoencephalogram was done without removal of spinal fluid. Observing 35 patients, they reported the following results: 1. During the injection of gas, 27 patients complained of headaches, severe in 20; 7 had nausea and vomiting; 1 complained of paresthesias, and 2 had convulsions (1 generalized and 1 of the Jacksonian type). 2. One or two hours later, headache had disappeared in 4 of the 27 patients with a headache and had become slight in 4 others and very slight in 8; 4 patients continued to complain of nausea and vomiting. 3. Three to six hours after the injection, of the 23 remaining patients with headache, 7 more were cleared up; 1 patient continued to have nausea; one had focal convulsions, and 3 more began to have nausea and vomiting. 4. Seven hours after the injection, 4 patients still had severe headache and 1 was still nauseated. 5. Twenty-four hours after the injection of air no patient complained of headache.

We believe that the use of helium instead of air allowed our patients even less discomfort than reported by Slosberg, Bornstein and Lichtenstein.[13] The late reactions include no severe headache, no convulsions and very rare vomiting. As for the immediate reactions, our incidence of lipotimias (17.1 per cent) and convulsions (11.4 per cent) seems to result, as was pointed out by Slosberg,[14] from the rapid introduction of the gas into the subarachnoid spaces; instead injecting 10 cc. of helium each thirty seconds, as we did in all of our 35 cases, we adhere now to Slosberg's advice that no more than 8 cc. be injected each sixty seconds.

As a result of the low incidence of severe reactions, we were able to secure good cooperation from the majority of patients, needed no postoperative medication of any kind in 74.2 per cent and were able to discharge all but 3.

We agree with Schwab, Fine and Mixter,[21] Fine, Hermanson and Frehling,[32] Turner and Brody,[30] Cleveland and End,[7] Grinker,[32] Kornreich,[25] Grinker and Bucy[9] and Davidoff and Dyke[8] that the postoperative inhalation of oxygen may further relief, but we omitted it in the present series in order to observe thoroughly the patients' reactions to the technic used.

SUMARIO E CONCLUSOES

Fez-se um estudo da tolerância à pneumoencefalografia, quando feita sem remoção de líquido encèfalo-medular e com uso do gás helio como meio de contrasts.

A literatura disponível foi revista.

35 pacientes foram observados, os resultados discutidos e a seguintes conclusões obtidas:

1a.) as reações à pneumoencefalografia, com o uso do hélio como meio de contraste, e sem remoção de líquor, são geralmente discretas e de curta duração.

2a.) Como resultado, o paciente coopera bem com o exame, raramente necessita medicação pós-operatória e às mais das vêzes exige períodos de hospitalização de pequena duração.

RESUMEN Y CONCLUSIONES

Se trata en este trabajo de la tolerancia de los mètodos neumoencefalográficos sin extracción de líquido cerebroespinal y empleando el helio como medio de contraste. Se pasa revisión a la literatura de referencia. Se han estudiado 35 casos y se llega a las siguientes conclusiones.

1.— La reacción del enformo al estudio neumoencefalográfico cuando no se extrae el l.c.v. y se usa el helio como contraste es de poca importancia y de corta duración.

2.— Como consecuencia de ello los enfermos colaboran bien y raramente requieren medicación postoperatoria siendo e tiempo de hospitalización de períodos sumamente cortos.

SUMARIO E CONCLUSOES

Discutem a tolerancia dos metodos pneumoencefalograficos feitos sem remoção de liquer e usando como contraste o helium. Fazem revisao da literatura e dizem que observaram 35 pacientes sobre os quais apresentam as seguintes conclusoes:

1. As reações são de curta duração e brandas usando-se o helium sem retirada de liquido;

2. Como resultado o doente coopera bem raramente desejando medicação posoperatoria e fica hospitalizado por curto periodo.

ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

Die Verträglichkeit der Pneumoenzephalographie ohne Ablassen des Liquors und unter Verwendung von Helium als Kontrastmittel wird erörtert. Über die einschlägige Literatur wird berichtet. Die an 35 Patienten beobachteten Resultate führen zu den folgenden Schlussfolgerungen:

1. Die Reaktionen von pneumoenzephalographisch ohne Absaugung der Spinalflüssigkeit und unter Verwendung von Helium als Kontrastmittel untersuchten Patienten sind gewöhnlich von kurzer Dauer und nicht schwerer Art.

2. Infolgedessen zeigen die Patienten gewöhnlich gute Kooperation; sie brauchen nur selten Arzneigaben nach dem eingriff und können im allgemeinen nach sehr kurzer zeit aus dem Hospital entlassen werden.

RÉSUMÉ ET CONCLUSIONS

Les auteurs présentent une étude sur la tolérance de la pneumoencéphalographie sans évacuation du liquide cérébrospinal, en prenant l'hélium comme moyen de contraste. Ils passent en revue la littérature parue à ce sujet et exposent leurs résultats dans 35 cas, aboutissant aux conclusions suivantes:

1. Les réactions présentées par les malades sont en général minimes et de courte durée.

2. La collaboration entre opérateur et malade est en général bonne. Un traitement postopératoire est rarement nécessaire et le plus souvent l'hospitalisation est de courte durée.

RIASSUNTO E CONCLUSIONI

Viene trattata la tecnica della pneumoencefalo-grafia seza estrazione di liquor e con l'impiego dell'elio come mezzo di contrasto. Furono studiati 35 pazienti, con i seguenti risultati:

1. Le reazioni del malato sono di breve durata e non gravi;

2. Il malato di solito coopera bene, raramente necessita di medicazioni post-operatorie e usualmente deve essere ospedalizzato solo per un breve periodo di tempo.

REFERENCES

1. Dandy, W. E.: Roentgenography of the Brain After the Injection of Air into the Spinal Canal, Ann. Surg. 70:397, 1919.

2. Bingel, A.: Die roentgenographische darstellung des gehirns, Klin. Wchnschr. 1:2191-2197, 1922.

3. Jungling, O.: Fortschritte dem gebiet der lokalisation von hirngeschwulsten durch ventriculographie nach Dandy, Arch. f. klin. Chir. 133: 449, 1924.

4. Liberson, F.: The Use of Various Gases in Encephalography: A Summary of 210 Cases, Using the Simultaneous Displacement Apparatus, Am J. M. Sc., 185:478-484, 1933.

5. Newman, H. W.: Encephalography with Anesthetic Gases in Man, Proc. Soc. Exper. Biol. & Med. 34:289-290, 1936.

6. Aird, R. B.: (a) Experimental Encephalography with Anesthetic Gases, Arch. Surg. 32:193-217, 1936. (b) Encephalography with Anesthetic Gases, Ibid. Arch Surg., 34:853-867, 1937. (c) Absorption of Ethylene Gas Following Encephalography with Clinical Correlation of 164 Cases, Radiology 30:320, 1938.

7. Cleveland, D., and End, E.: Helium in Encephalography, Surg., Gynec. & Obst. 74:760-762, 1942.

8. Davidoff, L. M., and Dyke, C. G.: The Normal Encephalogram. Philadelphia: Lea & Febiger, 1951. 3rd ed.

9. Grinker, R. R., and Bucy, P. C.: Neurology. Springfield, Ill.: Charles C Thomas, Publisher, 1949. 4th ed.

10. Kasahara, M.: Experimental Study in Meningeal Irritability, Am. J. Dis. Child. 28:407-414, 1924.

11. Peterson, J. N.: Injection of Air by the Lumbar Route in Diagnosis and Treatment, Canad. M.A.J. 19:184-189, 1928.

12. Epstein, S. H., and Von Storch, T. J. C.: An Improved Apparatus for Encephalography Adaptable to Ventriculography, Am. J. Roentgenol. & Rad. Therap. 34:451-456, 1935.

13. Slosberg, P.: Bornstein, M., and Lichtenstein, R.: Pneumoencephalography with Minimal Withdrawal of Cerebrospinal Fluid, J. Mount Sinai Hosp. 21:299-305, 1955.

14. Slosberg, P.: Personal Communication, 1956.

15. Haguenau, J.: De l'encéphalographie; etude d'une tecnique nouvelle, Ann. de Med. 22:268-285, 1927.

16. Friedman, E. D.: Snow, W., and Kasanin, J.: Experiences with Encephalography via the Lumbar Route, Arch. Neurol. & Psychiat. 19:762-795, 1928.

17. Pancoast, H. K., and Fay, T.: Encephalography: Roentgenological and Clinical Consideration for its Use, Am. J. Roentgenol. and Rad. Therap. 21:421-447, 1929.

18. Solomon, H. C., and Epstein, S. H.: Encephalography Under Narcosis Produced by Nonvolatile Anesthetics; a Note on the Technic, J.A.M.A. 98:1794-1796, 1932.

19. Vincent, C; Rappoport, F., and Berdet, H.: Sur l'encéphalographie gazeuse par voie lombaire, Rev. Neurol. 1:1070-1096, 1933.

20. Bohn, S. S.: The Reactions of Patients to Encephalography; An Analysis of One Thousand Consecutive Cases, Bull. Neurol. Inst. New York 6:540-568, 1937.

21. Schwab, R. S.; Fine, J., and Mixter, W. J.: Reduction of Postencephalographic Symptoms by Inhalation of 95 Per Cent Oxygen, Arch. Neurol. & Psychiat. 37:1271-1282, 1937.

22. Brain, R. S.: Recent Advances in Neurology. London: J. & A. Churchill Ltd., 1940. 4th ed.

23. Delay, J.; Soulairac, A., and Desclaux, P.: Le syndrome biologique de l'encephalographie gazeuse, Compt. Rend. Seanc. Soc. de Biol. 139: 296-297, 1945.

24. Nielsen, J. M.: A Textbook of Clinical Neurology. New York: Paul B. Hoeber, Inc., 1946. 2nd ed.

25. Kornreich, C. J.: Relief of Symptoms Following Encephalography by Combined Premedication and Use of Oxygen, Arch. Neurol. & Psychiat. 60:512-519, 1948.

26. Trowbridge, W. V.; Bayless, A. E., and French, J. D.: An Inquiry Concerning the Practical Value of Helium as an Encephalographic Medium, J. Internat. Col. Surgeons 21:441-446, 1954.

27. Schott, E., and Eitel, J.: Ueber encephalographie nach Bingel, Deutsch. Arch. f. klin. Med. 141:16 (summary, J.A.M.A. 80:882, 1923), 1922.

28. Buchanan, A. L.: Experiences with Encephalography, M. J. Australia 2:812-817, 1929.

29. Marotta, A. R., and Bustus, F. M.: Neumoencefalografia, Presna Med. Argentina 25:109-114, 1938.

30. Turner, O. A., and Brody, B. S.: The Retention of Intraventricular Air Following Encephalography; Report of Two Cases of Unusual Duration, Am. J. Roentgenol. & Rad. Therap. 46: 324-328, 1941.

31. Casamajor, L.; Laidlaw, R. W., and Kozinn, P. J.: The Technic of Pneumoencephalography in Children; Comparative Results with Air and Oxygen Injection, J. Pediat. 38:463-467, 1951.

32. Fine, J.; Hermanson, L., and Frehling, S.: Further Clinical Experiences with Ninety-Five Per Cent Oxygen for the Absorption of Air from the Body Tissues, Ann. Surg. 107:1-13, 1938.

33. Grinker, R. R.: Neurology. Springfield, Ill.: Charles C Thomas, Publisher, 1944. 3rd ed.

ADDITIONAL SOURCES

Duran, P.: Diagnostic encéphalographique. Paris: G. Doin & Cie, 1951. 1st ed.

Foerster, O.: Encephalographische erfahrungen, Ztsch. f. d. ges. Neurol. u. Psychiat. 94:512, 1924-1925.

Hepburn, H. H.: A Technic for Pneumo-Encephalography, Canad. M.A.J. 43:28-30, 1940.

Acute Carcinomatosis

SAMUEL ROSNER, M.D., F.I.C.S., AND A. ALFRED ZIVIELLO, M.D., F.I.C.S.

BRONX, NEW YORK

THIS is the case history of a patient who died of acute carcinomatosis after having undergone operation for an extradural fibroma of the cauda equina about six weeks earlier.

The patient was a 54-year-old woman on whom venous ligation of the lower part of the right leg was performed in April 1958. In March she began to complain of low back pain radiating down the left leg. In the middle of June incontinence of urine and feces developed, with progressive numbness of the anal area and both buttocks. The patient complained of generalized weakness.

In April she had complained of a sudden pain in the right side of the head, shooting into the right ear and down the side of the head.

The pertinent neurologic observations were bilateral absent ankle jerks, weakness of the anal sphincters and hypesthesia of the anal orifice and the vaginal-urethral area.

It was my opinion that a pressure syndrome existed at the cauda equina, at about the first sacral segment, and that the pressure was possibly due to a herniated disc or a neoplasm.

Myelographic study and surgical intervention were recommended and carried out on the same day, June 25. The former revealed an indentation of the column of dye at the first sacral level. The appearance was that of a tumor mass presenting posteriorly at that level.

Laminectomy was carried out as an emergency procedure. An extradural fibroma compressing the cauda equina from behind forward at the first and second sacral levels was removed completely. The pathologic status was confirmed by the hospital pathologist, whose description follows:

"*Gross*: Many small pieces of tissue from the spine—fibrous and calcific.

"*Microscopic*: Consists of fibrous tissue with small areas of degenerating cartilage. The fibrous tissue contains relatively few nuclei; these show pleomorphic changes.

"*Diagnosis*: Benign fibroma with degeneration of cartilage."

Roentgen examination of the chest revealed *increased density* at the left hilus.

There was no evidence of consolidation, infiltration or pleural effusion.

Roentgen examination of the gastrointestinal tract by means of a barium meal revealed the esophagus, stomach and small bowel to be normal.

Dr. Ziviello made a note on August 2 concerning the sudden formation of "multiple hard skin masses in the scalp, arms, abdomen, etc. Seem to be increasing rapidly. Abdomen: Liver enlarged and tender, palpable spleen. Malignancy must be thought of — *unknown cause.*"

On August 3 convulsions developed. These were generalized, although there were seizures involving the right side at first.

Dr. Ziviello excised two of the nodes, which were subsequently examined microscopically by Dr. Aronson, the hospital pathologist. The microscopic diagnosis was: "Growth from back."

The specimen revealed a pleomorphic malignant epithelial growth invading the skin and fascia. There appeared to be an attempt

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A case is reported in which a middle-aged woman, operated on for an extradural fibroma six weeks earlier, presented multiple malignant cutaneous masses within two days. On the day after excision of two of these masses the patient was in status epilepticus and died the next day. The diagnosis was carcinoma metastatic to the skin, probably from a primary tumor of an internal organ. Permission for autopsy was refused.

at gland formation. The diagnosis was metastatic carcinoma of the skin.

Later on August 3 the patient went into status epilepticus. She never regained consciousness, despite some alleviation in the number of attacks as a result of medication. She died on August 5.

SUMMARY AND CONCLUSIONS

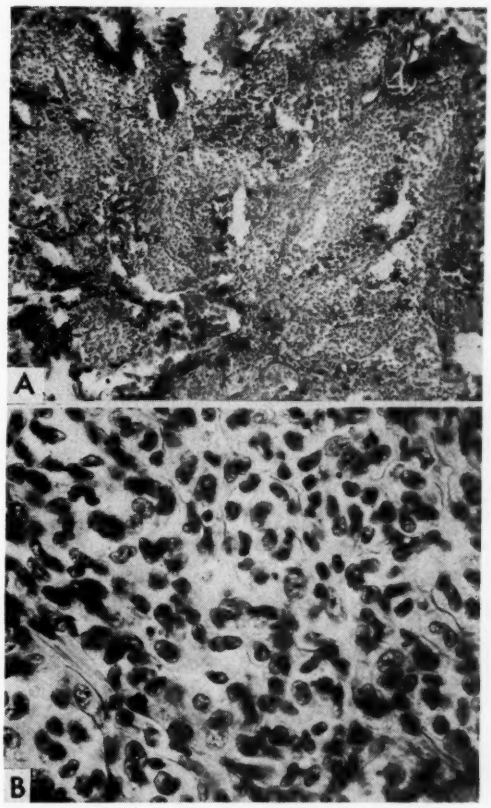
A case is reported in which a middle-aged woman, who had been operated on for an extradural fibroma six weeks earlier, presented multiple cutaneous masses within two days. These masses increased in number and in area covered. The day after excision of two of these masses, the patient was in status epilepticus and died the next day. A request for postmortem examination was refused.

The microscopic diagnosis was metastatic carcinoma to the skin (primary, probably, in internal organs).

The only signs suggestive of pathologic change in the internal organs were an area of increased density at the hilum of the left lung and an increase in size of the liver and spleen.

The rapid spread of these multiple tumors is highly significant in the light of present belief that there may be a viral cause of malignant disease. In the authors' opinion, this is the first description of acute carcinomatosis to be published.

Acknowledgment.—Sincere thanks are offered to Dr. William Aronson for his help with the pathological diagnosis.



Low power (*A*) and high power (*B*) photomicrographs of specimen.

ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

Es wird über den Fall einer Frau im mittleren Lebensalter, die, nachdem sie sechs Wochen vorher wegen eines extraduralen Fibroms operiert worden war, innerhalb von zwei Tagen multiple Hautgeschwülste entwickelte, berichtet. Die Geschwülste nahmen an Zahl zu und dehnten sich über grössere Gebiete aus. Am Tage nach der Resektion von zwei dieser Geschwülste befand sich die Patientin in einem Status epilepticus; sie starb am folgenden Tage. Erlaubnis zur Obduktion wurde verweigert.

Die mikroskopische Diagnose war die eines metastatischen Krebses in der Haut (die Primärgeschwulst lag wahrscheinlich in einem inneren Organ).

Die einzigen Zeichen, die auf krankhafte Veränderungen der inneren Organe hinwiesen, waren eine Vergrösserung des Hilusschattens der linken Lunge und eine Vergrösserung der Leber und Milz.

Angesichts der heutigen Anschauung, dass eine Virusinfektion als Ursache bösartiger Erkrankungen eine Rolle spielen mag, ist die rapide Ausbreitung dieser multiplen Geschwülste von grosser Bedeu-

tung. Der Verfasser glaubt, dass es sich hier um die erste Veröffentlichung einer akuten Karzinomatose handelt.

RÉSUMÉ ET CONCLUSIONS

L'auteur rapporte le cas d'une femme d'âge moyen opérée pour un fibrome extradural, chez qui sont apparves, six semaines après et en deux jours, des tumeurs cutanées multiples augmentant en nombre et en surface. Le lendemain de l'excision de deux de ces tumeurs la malade a présenté un état épileptique et est décédée le jour suivant. La demande d'autopsie a été refusée.

L'examen microscopique a montré un carcinome métastatique épidermique provenant probablement d'un carcinome primaire à point de départ des organes internes.

Les seuls signes pouvant suggérer une modification pathologique des organes internes étaient constitués par une zone de densité accue au niveau du hile du poumon gauche, et une augmentation de volume du foie et de la rate.

La propagation rapide de ces tumeurs multiples est des plus significative à la lumière du courant d'opinion actuel concernant la possibilité d'un virus à la base des affections malignes. L'auteur pense être le premier à publier la description d'une carcinomatose aiguë.

RESUMEN Y CONCLUSIONES

Se presenta el caso de una mujer adulta que habiendo sido operada seis semanas antes de un fibroma extradural se presenta de nuevo padeciendo desde hace dos dias de múltiples nódulos cutáneos. Estos nódulos crecen en número y en extensión. Al dia siguiente de la excisión quirúrgica de dos de estas tumoraciones la enferma entra en estado epiléptico muriendo en veinticuatro horas. El intento de autopsia es rechazado por los familiares. El diagnóstico microscópico fué de carcinoma cutáneo metastático (primario probablemente en órganos internos). Los únicos indicios de alteración visceral fueron aumento de la densidad del hilio del pulmón izquierdo e hipertrofia del hígado y del bazo.

La rápida propagación de estos tumores múltiples es altamente significativa a la luz de la creencia actual de la posibilidad de una causa virásica de los tumores malignos.

Para los autores se trata del primer caso descrito de carcinomatosis aguda.

SUMARIO E CONCLUSOES

Um caso e apresentado em que uma mulher de meia idade foi operada de um fibroma extradural tendo apresentado seis semanas antes massas cutaneas multiplas formadas em dois dias. Essas formações tumorais cresceram em numero e area. No dia em que foram estirpadas duas tumorações a paciente estava em crise epiletica e morreu no dia imediato. Foi recusada a necropsia. A histologia demonstrou carcinoma cutaneo mateastatico (primariamente de orgãos internos). Os unicos sinais sugestivos de degeneração maligna foram o aumento de densidade hilar no pulmão esquerdo e um aumento de tamanho do figado e baço. A rapida difusão desses tumores multiplos e altamente significativa de que houve uma causa virosica da molestia maligna. Na opinião do A. esta e a primeira descrição de carcinomatose a ser publicada.

Obstetric and Gynecologic Surgery

Cesarean Section and Ureterolithotomy

Report of Case

JOHN C. BROUGHER, M.D., F.A.C.S., F.I.C.S.

VANCOUVER, WASHINGTON

A case is reported of renal calculi occurring in pregnancy, the author's only such case in 7,000 deliveries. His impression that this condition is relatively rare is confirmed by the experience of others, and his decision to publish was based on the interest always attracted by the uncommon.

IT was not until Klempner and his coworkers[1] reported their interesting case and a review of the literature on renal calculi in pregnancy that I realized such a combination is rare and should be reported. The incidence of renal calculus during pregnancy is reported by Arnell and Getzoff[2] as 1 in 852. In 15,000 obstetric admissions, Balch[3] observed no instance of lithiasis.

REPORT OF CASE

Mrs. B. W. S., aged 32, was admitted to Dr. Robert Fitzgerald's urologic service in the Vancouver Memorial Hospital on June 9, 1956, in the eighth month of gestation, with ureteral colic, nausea and vomiting. Urinalysis showed 2 to 5 erythrocytes per high power field. An intravenous pyelogram suggested a calculus in the middle third of the right ureter. An emergency cystoscopic study and retrograde ureteral catheterization were done. Dr. Fitzgerald by-passed the stone and pushed it high in the ureter, relieving the pain and fever. The ureteral catheters were left indwelling. I was then called in consultation for management of the pregnancy and delivery. The temperature was 100 F., the pulse rate 120 and the respiratory rate 22. The patient was in acute pain and manifested tenderness over the right kidney. I concurred in the plan to continue ureteral drainage. Abdominal examination showed the uterus about the size to be expected at the thirty-fourth to thirty-sixth week of gestation. The fetal heart tones were of good quality. Vaginal examination revealed a well-effaced cervix. Induction of labor or, alternately, cesarean section was considered, with the plan of removing the stone at the time of the section or after vaginal delivery.

On the following day, with the catheters in the ureters, the patient's temperature became normal and she was able to void. Her pain was now minimal. Culture of the urine showed gram-positive cocci in groups, and a presumptive diagnosis of hemolytic staphylococcus was made. The patient was given 2,000 cc. of 10 per cent dextrose intravenously, and chloromycetin was started. Demerol was administered for relief of pain.

On June 11 a roentgenogram of the kidney, ureter and bladder demonstrated the stone high in the right ureter. The catheters were draining, and the patient was comfortable. On the following day the catheters were removed, and the patient remained comfortable five hours after being ambulatory.

On June 13 a film of the same organs showed the calculus in the midureter, but the patient continued to be free of pain. Although gestation was judged at thirty-four to thirty-six weeks, it was decided, because the fetus appeared small, to allow the patient to pro-

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gress nearer to term if she had no more colic. She was discharged from the hospital on a Mandelamine regimen and instructed to return if any change occurred.

On June 15 the patient was readmitted with acute pain and marked tenderness in the right flank, probably resulting from ureteral obstruction. Dr. Fitzgerald did an emergency cystoscopic examination and ureteral catheterization, leaving two catheters indwelling on the right. The pain was relieved, and further care was discussed. Dr. Wayne Holmes, consultant in obstetrics, favored cesarean section followed by tubal ligation and removal of the renal calculus by Dr. Fitzgerald. Sterilization was favored for socio-economic reasons, the patient having borne 8 children.

Since the hemoglobin level was 8.8 Gm., or 63.7 per cent, and the erythrocyte count 3,380,000 per cubic millimeter, a unit of blood was given on June 17. On June 18, Dr. Fitzgerald explained to the patient the plan for removal of the stone after the cesarean section, and warned her that it might not be possible to obtain the stone if it should slip back into the kidney or if for any reason, her condition would not justify additional surgical intervention. The section was performed on June 19. The abdomen was opened through a low midline incision. The uterus was approached by the low transverse cervical route. Fibroids were observed in the uterus, and one in the line of incision was removed. The baby was delivered, the Murless extractor being used for the head. The uterus was closed, and this was followed by tubal ligation and resection by the Pomeroy technic.

Dr. Fitzgerald's report of the operative procedure was as follows: "Through the incision made for the cesarean section, the right ureter was identified through the posterior peritoneum. The calculus was identified and localized between 2 fingers, after which an incision was made directly over, through the posterior wall of the peritoneum, carrying the incision into the ureter. The stone was easily removed. The ureteral catheter was not disturbed. One interrupted chromic catgut suture was placed in the ureteral incision. A retroperitoneal Penrose drain was placed posterior to the peritoneum through a stab incision in the flank. The posterior peritoneal incision was then closed with continuous chromic catgut suture. The incision was closed by Dr. Brougher with my assistance, with use of the usual closure technic."

The ureteral catheters were both withdrawn when the operation was completed. The patient was given a unit of blood and returned to her room in good condition.

The pathologic diagnosis (made by Dr. Donald T. Morrison) was as follows: "Examination of placenta: Intact placenta identified, focally lacerated. Uterine myomectomy: Leiomyoma of uterus, benign. Segmental salpingectomy, bilateral: Multiple (2) segments of oviduct identified. Ureterolithotomy: calcium oxalate. Calcium phospate calculus identified."

The baby died shortly after delivery. The primary cause of death was the presence of multiple congenital anomalies, predominantly involving the abdomen. The immediate cause was apparently asphyxia neonatorum, abetted by the congenital deformity of the thoracic cage and kyphosis of the spine.

On the following day there was minimal drainage from the stab incision on the right, and minimal discomfort was noted. The output of urine was adequate, but there were nausea and distention. The catheter from the bladder and the drain from the flank were removed on the third day. The patient continued to progress satisfactorily. The highest postoperative temperature was 101 F., which persisted for two days. The patient was discharged on the fifth postoperative day. There has been no recurrence of renal calculi.

CONCLUSION

Since the patient whose case is reported here was the only one with renal calculi in 7,000 deliveries, and since such a complication has been reported only infrequently, one may infer that the complication is relatively rare.

SCHLUSSFOLGERUNG

Die Patientin, über die hier berichtet wird, stellt unter 700 Entbindungen, die der Verfasser ausgeführt hat, den einzigen Fall mit Nierensteinen dar. Aus diesem Grunde, und da auch sonst nur selten derartige Fälle veröffentlicht worden sind, darf man annehmen, dass es sich um eine verhältnismässig seltene Komplikatation handelt.

CONCLUSIONES

Toda vez que se cita en este trabajo una litiasis renal entre 7.000 partos asistidos por el autor y ya que esta complicación ha sido citada solo excepcionalmente se infiere que se trata de una complicación relativamente raral.

CONCLUSIONI

Su 7000 parti vi fu soltanto una donna con calcolosi renale; poichè anche nella letteratura questa complicazione viene riferita solo molto raramente, si può concludere che essa sia realmente infrequente.

CONCLUSIONS

Rapport sur un cas de calculs rénaux, considéré comme rare du fait que c'est l'unique complication de ce genre rencontrée par l'auteur sur un total de 7.000 accouchements pratiqués, dont on ne trouve que peu d'exemples dans la littérature.

REFERENCES

1. Klempner, E.; Kaplan, S.; Shapiro, L., and Oppenheimer, G.: Ureterolithotomy During Cesarean Section, Am. J. Obst. & Gynec. 74:1089-1091 (Nov.) 1957.

2. Arnel, R. E., and Getzoff, P. L.: Renal and Ureteral Calculi in Pregnancy, Am. J. Obst. & Gynec. 44:34-46 (July) 1942.

3. Balch, J. F.: Urinary Calculus Association with Pregnancy: A Consideration of Management with Report of Three Cases, J. Urol. 47:705-710 (May) 1942.

TO ALL CHAIRMEN AND PARTICIPANTS IN THE TWENTY-FOURTH ANNUAL CONGRESS

Your attention is urgently called to the announcement on Page 158 of this issue of the *Journal.* Your full and generous cooperation will enable the Editor and his staff to eliminate unnecessary confusion and delay in publishing the fine presentations offered at the Congress and to the Journal for subsequent publication.

Chairmen are requested to send to Dr. Max Thorek, Editor-in-Chief, as soon as possible after the Congress, *a list (in duplicate) of all papers remaining in their hands for appraisal,* and *to remind the authors that a complete copy must also be sent direct to the Editorial Office.*

Participants will find their interests best served by *reading carefully the announcement on Page 158 and complying with the extremely important procedure therein outlined.* We can assure those who contribute to the *Journal* that they will not regret this invaluable contribution to author-publisher relations.

Orthopedic Surgery

Stress Fractures of the Tibia

Analysis of Thirty-Five Cases

JAMES S. BENEDICT, M.D.
DES MOINES, IOWA

As the modern world continues to demand the maintenance of a large military force, so the diseases associated with military life will be necessarily more prevalent. Whether the cause lies in the complicated effects of outer space upon the human body or in the simple rigors of basic recruit training, medicine will be confronted with problems peculiar to each field of military specialization.

From the Orthopedic Service, USNH, Camp Pendleton, California.
Submitted for publication Nov. 10, 1958.

Stress or march fractures of the tibia occur frequently in vigorous, healthy young men, particularly those in recruit training. The universal symptom of pain over the shinbone on weight bearing, combined with localized tenderness to pressure, usually associated with swelling, should arouse one's suspicion. Roentgenograms will reveal the identity of the lesion after two weeks. Treatment consists of the use of crutches, with no weight upon the involved leg for six weeks, followed by one or two weeks of physical therapy and full weight bearing. The importance of this lesion in the differential diagnosis between bone tumor, osteomyelitis and thrombophlebitis cannot be overemphasized.

At the United States Naval Hospital, Camp Pendleton, patients from the large Marine Corps base were noted to have rather frequent and numerous stress fractures of the tibia. Most of them were from the Infantry Training Regiment or had recently been transferred from boot camp. The occurrence of stress fractures in civilian populations is rare; many civilian-trained physicians rarely, if ever, encounter them. The infrequency of reports of the fracture in the literature prompted this report of a comparatively large number of cases.

Civilian physicians, and especially military personnel, should be aware of the possibility of stress fractures, as the rigorous athletic activities of modern society with leisure time include hiking, mountain climbing, organized ball games, water sports and winter activities. Such a fracture may often go unrecognized if the clinician is unaware of its frequently occult nature.

It behooves the physician and the surgeon alike to be alert to pain on weight bearing and swelling over the leg, combined with localized tibial tenderness. Such symptoms may be attributable to a stress or march fracture of the tibia.

Historical Data.—"March" fractures in the feet were first described as a syndrome

Fig. 1.—Case of an 18-year-old private with onset of pain on walking. Swelling was also present, with localized tenderness over upper third of tibia six weeks prior to admission. Roentgenogram taken on admission (*left*) shows periosteal reaction on posterolateral aspect, 4 inches (10 cm.) below knee joint. Fracture line was visible on original film. *Right*, same fracture after six weeks on crutches, with no weight bearing. Fracture line has been obliterated and calius has become firm bone.

by Breithaupt in 1855, as a condition occurring in soldiers after forced marches. Pauzat described a similar condition in French soldiers in 1887, which he had observed during maneuvers of the 77th infantry regiment in 1884. After the advent of the roentgen tube, the real nature of the fractures became apparent. By the close of World War I the literature was full of reports of march fractures of the metatarsals.

The first description of the clinical entity known as march fracture of the tibia was probably the series reported by Aleman in 1929. He described a condition he called *periostitis ab exercitio*, which consisted of merely abundant callus over the upper part of the tibia on roentgen examination. He saw no fracture line, but reported that more than 100 cases per year were observed in the Swedish Army.

For twelve years Ollonqvist observed the condition in the Finnish Army (since 1925), estimating an average yearly freqency of 60 tibial to 90 metatarsal fractures per year. He also saw only the callus and the periosteal proliferation of new bone and termed the condition *osteopathia itineraria tibia* (Latin: *iter, itinere*, to walk).

Genz was the first to associate the callus formation with a defiinite fracture line. He observed the fracture arising from the

rigid marching step of the German Army in 1935. The extensive use of skis and snowshoes may have had some relation to the large number of fractures noted in the Swedish and Finnish Armies.

In 1938 Hansson introduced the term "insufficiency fracture," in reporting 2 fractures of the tibia and 1 of the femur. He demonstrated that such fractures occur not only in the metatarsals but in the tibia, the femur and perhaps other bones. Of significance in his cases was the observation that the fracture line was not always seen on the roentgen film.

Perhaps it was because of no compulsory military training that march fractures of the tibia were not described in the American literature prior to the early 1940's. In fact, the first report came in 1939 from Roberts and Vogt, who observed 12 such fractures in children over a four-year period. In their opinion this group represented a new clinical entity, which they called pseudofracture. The location, the age of the children (from 4 to 16 years), the roentgen observations and the response to treatment make it almost certain that these were examples of the now well recognized stress fracture of the tibia.

After World War II broke out and a large proportion of the world's youth became involved in rigorous training, the reported incidence of tibial march fracture increased. In 1958, Devas summarized all reported cases, a total of only 78. Most

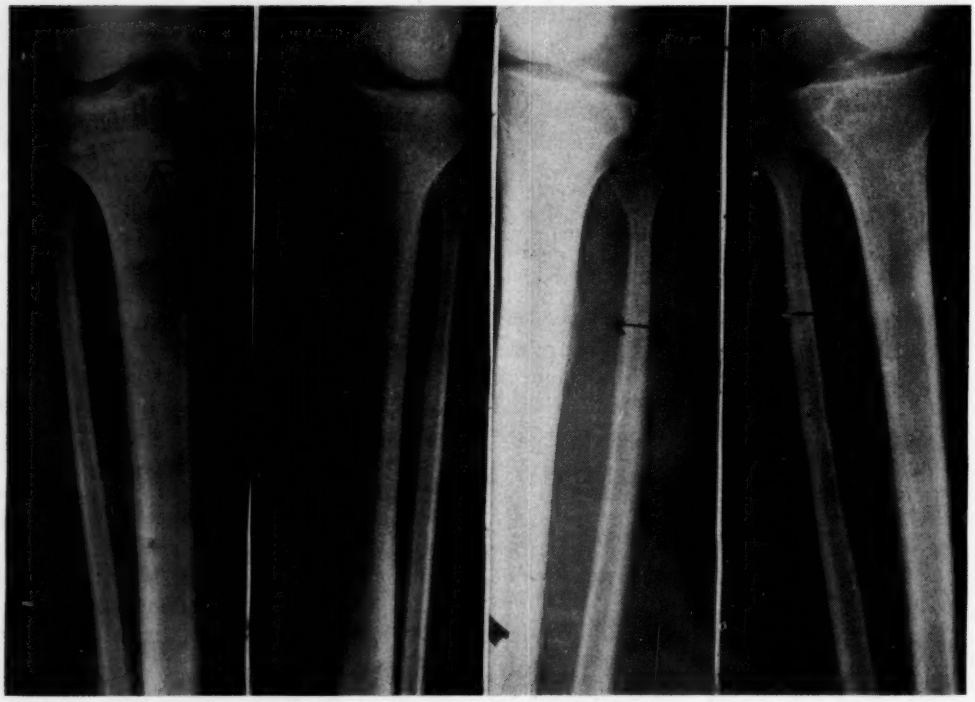

Fig. 2.—Case of an 18-year-old private admitted to hospital with bilateral stress fractures. Symptoms have been present for four weeks. *Left*, very slight periosteal proliferation about tibia, 4 inches (10 cm.) below knee. *Right*, lateral view, on which callus is much more evident. Thin fracture line was visible on original film. Patient was treated at bed rest for four weeks, after which ambulation was permitted.

Fig. 3.—Case of a 23-year-old private who was being treated for stress fracture of left leg when pain developed in right leg. *Left*, admission roentgenograms; *right*, roentgenograms of right knee, with newly discovered stress fracture about 2 inches (5 cm.) below knee joint. After six weeks with no weight bearing for either leg, patient was asymptomatic and was returned to duty.

reports presented 2 or 3 cases, the largest previous consisting of 15 cases.

Differential Diagnosis. — The importance of these lesions of the tibia concern chiefly the surgeon and the roentgenologist, who must try to differentiate between malignant and benign bone tumor and osteomyelitis or thrombophlebitis. Frequently the exact nature of the process can not be determined until roentgenograms have been taken repeatedly, at spaced intervals and at diverse angles. Tabb and Packer emphasized the fact that the importance of stress fractures of the tibia lies in the differential diagnosis. One of their patients was thought to have Ewing's sarcoma and the other osteomyelitis.

Other conditions to be considered were mentioned by Proctor, Campbell and Sobelle. Garre's sclerosing osteomyelitis, periostitis, bone syphilis, osteogenic sarcoma and tuberculosis of bone are mentioned. I should like to add thrombophlebitis, osteoid osteoma, subperiosteal hematoma and rupture of the gastrocnemius muscle.

Etiologic Factors. — The exact mechanism of production of the fatigue or stress fracture is a matter of speculation. It is not known why the bone of one recruit exposed to the same trauma as that of another will undergo the fracture while the other does not.

Wells expressed the opinion that the fracture occurs not because of mechanical weakness or anatomic variation but as a result of physiologic weakness secondary to fatigue, brought on by keeping the recruit going after he tires. When this occurs, the poor tone of the muscles no longer protects the bone. The weight of the body, often increased by a pack, is borne by the bones and ligaments which allow repeated micromotion of the bone itself. Eventually the bone will break, much in the same manner as a wire breaks with repeated bending.

Robertson states that it is "from rhythmically repeated mechanical stress at the point of greatest bone bending which produces fractures of individual trabeculations. Metal breaks because crystallization occurs at the site of the fracture. It is interesting that crystallization occurs at the site of the fracture, by electron microscope."

Burrows, on the other hand, attributed the fractures to a distracting force at one cortex and a compression force at the opposite cortex on bending. According to Proctor, Campbell and Sobelle, the rhythmic mechanical stress is the alternate thrust of the body weight down each leg during each step; the tibia is bent anterolaterally with each step, the microtrauma occurs at the site of greatest bone bending (the upper part of the tibia), and when the saturation point of traumatism is reached, the fracture is complete.

Nickerson advised that more importance be attached to the fact that the site of the fracture is near the attached muscle bellies. This might affect the increased circulatory response over a prolonged period, say during a march. This in turn might result in localized nutritional changes, leading to decalcification of bone in a linear fashion similar to the "umbanzonae" described by Loeser in the so-called "milkman's syndrome." A weakening of the cortex might then lead to complete fracture under added trauma. Nickerson divided the mechanism into two phases: (1) local decalcification due to nutritional changes (initial stage) and (2) beginning break in the peripheral portion of the cortical layers. He suggested the term "insufficiency fracture" and made the diagnosis before the fracture line is apparent, merely by the early periosteal proliferation.

Perhaps the real cause of the fracture is a combination of several of the aforementioned theories. Most likely there is an early subperiosteal fissure in the cortex due to (1) fatigue from recurrent bending strains, (2) traumatic fissure from an earlier minor compression injury, such as that caused by stepping in a hole, or (3) osteoclasia (or gap) from local nutritional disturbances or disease, such as rickets, osteomalacia or hunger osteopathy.

When additional periods of added strain of an accentuated normal activity or abnormal amplitudes of a single stress combine with the cortical fissure, the actual fracture occurs, causing clinical symptoms. Frequently the fatigue fissure or traumatic fissure in the cortex may heal without going on to frank fracture. The location of the infraction in the cortex

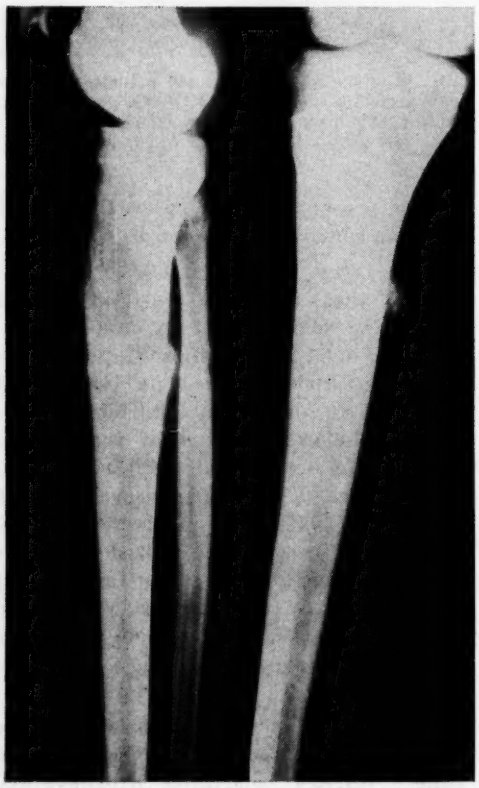

Fig. 4.—Roentgenogram showing abundance of callus in sunburst formation, which aroused strong suspicion of bone tumor. Serial roentgenograms revealed true nature of lesion: stress fracture.

that leads to the actual fracture seems to be determined by the location of the bone stress. Thus, in recruits, the greatest number of fractures occurs in the upper third; in ballet dancers, in the middle third, and in athletes, in the lower third.

Other investigators have studied the role of chemical and hormonal influences in causing the fractures. All serum studies have failed to reveal any abnormality of calcium, phosphorus, acid or alkaline phosphatase or other metabolites closely related to bone production. Investigation of body types, nationalities and occupations has also been fruitless. Most writers are convinced, however, that a point common to all histories is the repeated appearance of the lesion in persons who have been engaged in relatively inactive pursuits prior to being subjected to greater stress.

Pathologic Picture.—As the disease is not fatal, the study of pathologic specimens is rarely reported. Most microscopic sections have come from biopsies, so a complete section of the fracture site is not done. The specimens nearly always show fibrosis, cellular infiltration and typical bone regeneration and repair.

A more thoroughgoing study of a metatarsal stress fracture was reported by Hullinger and Tyler, who described the dynamic pathologic process as follows: "Because of repeated minimal trauma, there is an incomplete fracture of a few boney trabeculations, often not seen on roentgenogram. This is followed by hemorrhage, which being on the surface of the bone, produces an elevation of the periosteum. New bone is formed in the hematoma. Calcium deposition is seen in this area at an early date.

"If the trauma continues, there is fracture of additional trabeculations and additional hemorrhage. This further elevates the periosteum and gives additional osteogenesis. There is then slight absorption of calcium at the fracture with dehiscence becoming visible by X-Ray.

"If trauma ceases, the fracture then proceeds to orderly healing with complete repair. The periosteal callus becomes dense and spindle shaped and new trabeculations are seen traversing the fracture site. Variation of this picture depends upon the continuation of the trauma."

Clinical Manifestations.—A review of all cases of stress fracture of the tibia observed from July 1, 1954 to June 30, 1958, formed the basis for the following discussion. During this four-year period, 35 patients with such fractures were admitted to the orthopedic service. Fifteen were admitted in the six months from January 1 to June 30, 1958. In the first two years very few were admitted, but the incidence rapidly increased after the First Marine Division returned from overseas duty in 1946. Earlier, many of the dispensary physicians were unaware of the existence of such fractures, and the "negative" roentgenograms misled them in the treatment in the early stages. The sudden increase in the number of admissions during the later part of the study was probably directly related to the degree of suspicion aroused by the dispensary medical officer.

The patients ranged in age from 17 to 23 years, with an average age of 18. There was no correlation between body build and the incidence of fracture. All body types were included, from a man 5 feet 3 inches tall, weighing 143 pounds (64.9 Kg.), to one 6 feet 3 inches tall, weighing 185 pounds (83.9 Kg.). All were young healthy, athletic men. No women were included, though female Marines were stationed at the base and frequently took part in vigorous training exercises.

The geographical background was highly variable, with nearly all the states represented. Racial characteristics also were unimportant; Mexican, Negro, Cau-

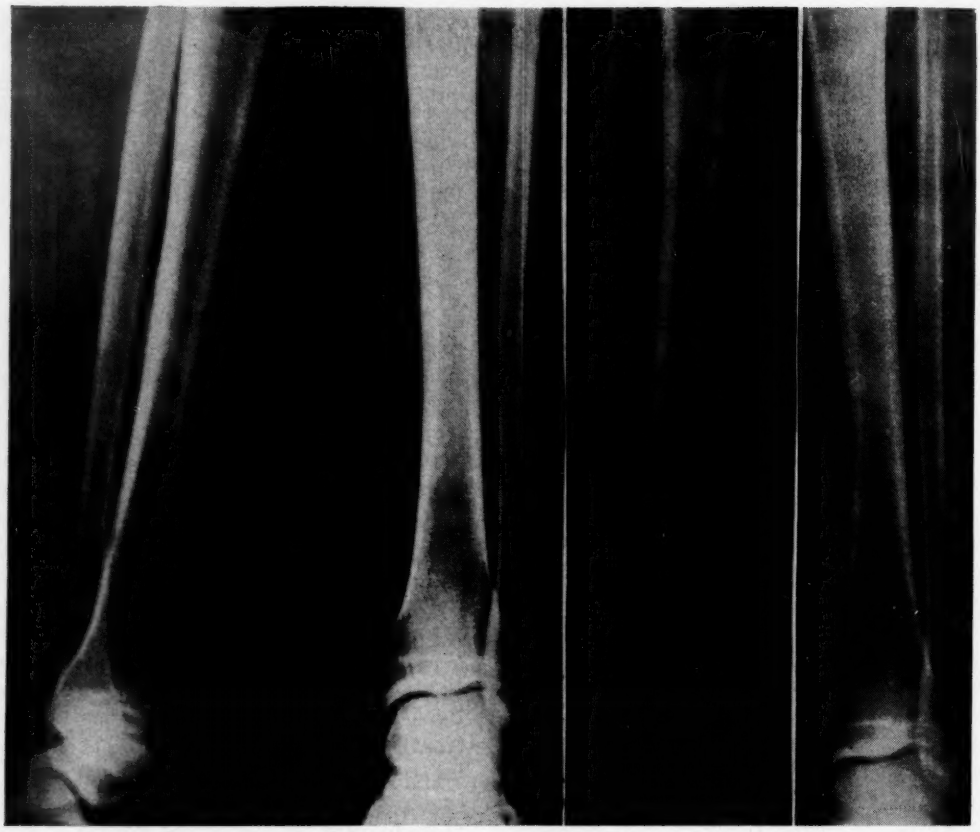

Fig. 5.—Case of an 18-year-old private who had had pain over lower part of tibia for six weeks prior to admission. Roentgenograms, taken two weeks apart, revealed fracture line at site of periosteal elevation and callus formation.

casian, Jewish, Mediterranean and Scandinavian stocks were included in the group.

The occurrence was roughly equal between the right tibia (40 per cent) and the left (46 per cent). There were 3 cases of bilateral stress fracture (14 per cent).* These figures roughly approximate those of Wells in his series. The site of occurrence in the bone has been stated to be related to the stress placed upon the bone. This is highly variable with the individual patient, though the most common site (66 per cent) was between 3 and 5 inches (7.5 and 12.5 cm.) below the knee joint, at the juncture of the proximal and middle thirds of the tibia. Ten per cent were 2 inches (5 cm.) or less below the knee joint, and 14 per cent were below 6 inches (15 cm.) in the middle third. An additional ten per cent were in the distal third.

Symptoms had been present in all patients for at least five days prior to admission, 1 patient having complained for four months. The average duration of symptoms prior to admission was five weeks. This probably reflected the lack of acquaintance of the dispensary medical

*Between June 30, 1958 and Sept. 30, 1958, an additional 3 patients with bilateral stress fractures of the tibia were admitted.

officers with the fracture. As they became more familiar with it, patients were admitted one or two weeks after the onset of symptoms.

The history was characteristic in most of the cases. Eight patients (23 per cent) had a history of minimal trauma preceding the fracture. In all, the trauma occurred at least four hours prior to the onset of pain and during a vigorous training exercise. Patients often attempt to relate the onset of pain to some specific injury, so this may actually influence their concepts as to cause and effect. In 77 per cent of cases there was absolutely no history of any traumatic incident. Nearly all had participated in prolonged marches, obstacle courses or organized athletics. Swelling (26 per cent) and limping (10 per cent) were infrequent. The universal symptom, present in every case, was the spontaneous onset of pain over the leg on walking, marching or running. In the early stages the pain would be relieved by rest, whereas later it would occasionally persist after weight had been removed from the leg. The occurrence of night pain in some of the latter cases caused considerable concern on early observation.

The classic physical sign was localized tenderness on pressure over the fracture site. Seventy-five per cent had swelling over the same site, about half presenting a soft tissue swelling and half a hard, firm mass on the tibia. Three had 2 plus and 1 had a 4 plus pitting edema. Six showed a definite increase in heat, and 5 had visible erythema. Only 4 had a marked limp.

The roentgen findings on admission were usually related directly to the duration of symptoms. In 39 per cent these consisted only of early periosteal proliferation, with symptoms present for six weeks or less. In 61 per cent there was a definite fracture line and/or callus about it. In the latter cases symptoms had been present for two weeks or more. Follow-up films frequently confirmed these data, showing the course of orderly healing.

Several admitting diagnoses differed from the actual diagnosis, which confirms the fact that the differential diagnosis is not easy. Osteomyelitis, Ewing's sarcoma, congenital deformity, osteoid osteoma and thrombophlebitis were some of the various admitting diagnoses. Two patients had been treated for three weeks with anticoagulants for thrombophlebitis before the diagnosis was made. Each had pitting edema, but both had a negative Homan's sign. Tomograms, serial roentgenograms and careful clinical appraisal were utilized in those cases in which bone tumors were suspected. The pain usually subsided rapidly on a non-weight-bearing program. No tumors developed in those whose lesions were diagnosed initially as stress fracture. No generalized reaction, as indicated by elevated white blood cell counts, occurred, nor was there any fever, as might be expected with osteomyelitis.

Detailed laboratory and blood chemical studies were discontinued after a few early cases indicated the fruitlessness of searching for chemical or hormonal imbalance. Diagnosis could be readily made in most cases on the history, physical examination and roentgen examination alone. Routine blood counts, urinalyses, and microthoracic films consistently gave negative results.

Treatment.—The method of treatment was as variable as the number of medical officers passing through the orthopedic service during the four years. This offered a good opportunity to evaluate the worth of the different methods. In 24 cases (61 per cent) the only treatment was a non-weight-bearing regime on crutches, varying in duration between two and eleven weeks. Many of the patients were known to start "cheating" with light weight bearing as soon as the pain subsided. Seven were placed in long-leg walking casts, about half of them because

they refused to cooperate with the crutch program. Two with bilateral fractures were ordered bed rest for four and eight weeks respectively, whereas in the third a second fracture developed while he was on crutches for the first. Two were continued on weight bearing in a light duty status and were returned to duty in sixteen and five weeks respectively, each still complaining of pain on discharge, even though the roentgenogram showed the fractures healed.

The average period of hospitalization for those treated on crutches alone was eight and eight-tenths weeks; for those in casts it averaged twelve and four-tenths weeks. The added time to rehabilitate the knee and ankle joints as well as the musculature of the leg accounted for this difference. The actual duration of treatment was necessarily somewhat prolonged, as all patients were expected to return to an active physical fitness program upon release from the hospital. This frequently meant returning the men to the same stress that had caused the fracture in the first place.

Wells' experience was similar, except that all his patients were kept in long leg walking casts for six weeks, returning to duty in two or three months. David, Murray, and Falkirk emphasized that the "protection of a long leg plaster should always be advised—unprotected activity may turn a fatigue fracture of the tibia into a displaced fracture." Though it is true that added protection is given the fracture site and that "cheating" is obviated by the use of the cast, the prolongation of rehabilitation and the discomfort to the patient seems to make this unnecessary.* The rapidity of healing was no more rapid in casts, and the use of crutches saved the cost of applying frequent plaster casts, which frequently did not withstand abuse by irresponsible patients. Nearly all the patients became adept in the use of their crutches and could carry on light duties about the hospital with no difficulty.

During the last year of the series the recommended treatment was as follows: 1. Explain carefully to the patient his responsibility in a non-weight-bearing program for a full six weeks, plus the necessity of cautious activity. 2. Permit ambulation on crutches, with no weight on the affected leg, for six full weeks. 3. At the end of the allotted time, allow full weight bearing. 4. If there is no pain on weight bearing and physical therapy for two weeks, return the patient to duty. 5. If the pain returns, place the patient on crutches for an additional two weeks.

Usually the pain on direct pressure over the fracture site had subsided by the end of the third week. If it persisted longer, investigation usually revealed that the patient had been "cheating" and bearing weight.

REPRESENTATIVE CASES

CASE 1.—A 19-year-old private from Minnesota entered the hospital complaining of pain in the left calf for four weeks prior to admission. Roentgenograms in the dispensary had showed a small crack in the tibia, but no relief had been obtained from whirlpool therapy and light duty. He had first noticed it while running, in the Infantry Training Regiment.

The patient was 6 feet 2 inches tall. There was a hard, tender, swollen mass on the left tibia, 6 inches (15 cm.) below the knee joint. A non-weight-bearing regime on crutches was maintained for five weeks. After full ambulation for one week, the patient was returned to duty in six weeks, asymptomatic.

CASE 2.—An 18-year-old private first class from Louisiana noted the gradual onset of pain over the lower part of the right leg three weeks prior to admission. There was no history of trauma other than several long marches. Physical examination showed a warm, painful, swollen, erythematous lesion over the lower third of the right tibia. A bone tumor was suspected, but tomograms and serial films soon revealed the stress fracture.

*In September 1958, three weeks after admission, a patient admitted walking without his crutches. He fell off a hospital porch, displacing the fracture and breaking the fibula also.

A non-weight-bearing program was maintained for eight weeks, followed by full weight bearing and physical therapy for another four weeks. The patient returned to duty in twelve weeks, asymptomatic.

CASE 3.—A 19-year-old private from Texas related his sore right leg to diving into a foxhole five days prior to admission. The leg did not become sore until five or six hours after this injury, even though he continued in his maneuvers. Three days prior to admission he fell down a small hill while running because of the severity of the pain. On the day of his admission he went on a long hike, and the leg became so swollen and painful that he was unable to stand on it. He was seen by his medical officer in the dispensary and admitted to the medical service with a diagnosis of acute thrombophlebitis. Examination showed this patient was 5 feet 5 inches tall and weighed 185 pounds (83.9 Kg.). There were marked swelling and tenderness of the right leg, with 4 plus pitting edema. Some redness and increased warmth were noted over the upper part of the calf and a negative Homan's sign was negative. Roentgen plates accompanying him from the dispensary were interpreted as normal. Bed rest, with elevation of the right leg and treatment with anticoagulants, was ordered. In ten days of bed rest the patient was asymptomatic. Upon ambulation in the third week there was a return of the pain. A repeat roentgenogram at that time showed a stress fracture. Physical examination now revealed a fusiform firm tender mass 3 inches (7.5 cm.) below the knee joint. A non-weight-bearing program was maintained for four weeks, after which ambulation was allowed. The pain returned, so weight bearing was discontinued for three more weeks. The patient went home on leave and returned asymptomatic, returning to duty eighteen weeks after the initial admission.

CASE 4.—A 17-year-old private from Colorado was admitted with pain in both legs. Three weeks prior to admission, while "double timing" with a heavy pack, he had noted the gradual onset of pain in both legs, aggravated by running and relieved by rest. He was 5 feet 11 inches tall. He walked with a guarded gait, favoring both legs. There was a swollen area, tender to direct pressure, over the upper third of the right tibia and another area over the lower third of the left tibia. Roentgenograms revealed bilateral stress fracture. Bed rest was ordered for four weeks, followed by limited weight bearing for two weeks. He was returned to duty in six weeks, with occasional tenderness.

CASE 5.—A 23-year-old private first class from Nebraska fell down a small incline two weeks prior to admission to the hospital. Two days later he noticed pain on walking, which gradually increased during subsequent marches. The pain was limited to the right tibia at the time of admission. Physical examination showed a palpable, hard, firm, tender mass over the upper third of the right tibia. After three weeks of a non-weight-bearing program on crutches the pain had disappeared on the right, but the patient began to complain of pain in the left knee. Two weeks later, a roentgenogram of the left knee revealed a stress fracture of the left tibia, 2 inches (5 cm.) below the knee joint. The patient's weight-bearing program was reversed for an additional six weeks. At twelve weeks from admission he was started on a full weight-bearing program. In two weeks he was asymptomatic and was discharged to duty.

ZUSAMMENFASSUNG

Marschfrakturen der Tibia werden häufig bei kräftigen jungen Männern besonders zur Zeit der militärischen Ausbildung beobachtet. Das Symptom von Schmerzen über dem Schienbein beim Tragen von Lasten und das gleichzeitige Bestehen örtlicher Druckempfindlichkeit, gewöhnlich mit Schwellung verbunden, sollte den Verdacht auf Marschfraktur erwecken. Röntgenaufnahmen lassen die Erkrankung nach zwei Wochen erkennen. Die Behandlung besteht in der Verwendung von Krücken unter Ausschluss der Belastung des erkrankten Beines für die Dauer von sechs Wochen. Danach erfolgt physikalische Behandlung für ein oder zwei Wochen und dann volle Gewichtsbelastung. Die Wichtigkeit dieser Erkrankung in der Differentialdiagnose von Knochengeschwülsten, Osteomyelitis und Thrombophlebitis kann nicht überschätzt werden.

RESUMEN

Las fracturas de la marcha o por stress de la tibia aparecen frecuentemente en

sujetos vigorosos y jóvenes, especialmente durante la instrucción militar. La aparición del clásico síntma de dolor sobre la cresta tibial al andar con peso jantamente con sensibilidad a la presión e hichazón debe hacer sospechar esta lesión. La exploración radiográfica identifica la lesión después de dos semanas. El tratamiento consiste en el uso de muletas para descargar el miembro afecto durante seis semanas seguidas de ostras dos de marcha con carga normal y fisioterapia. No hace falta llamar la atención sobre la importancia del diagnóstico de esta fractura con los tumores óseos, la osteomielitis y la tromboflebitis.

RÉSUMÉ

Les fractures d'effort ou de marche du tibia se rencontrent souvent chez des hommes jeunes et vigoureux, surtout à la période d'entraînement des recrues militaires. Le symptôme caractéristique de la douleur du tibia à la station debout, associé à une sensibilité locale à la pression en général accompagnée d'un oedème devraient donner l'éveil au praticien. Les radiographies montrent une lésion restant inchangée 15 jours plus tard. Traitement: béquilles pendant six semaines afin de supprimer le poids du corps sur le membre atteint, puis une ou deux semaines de thérapeutique physique avec tout le poids du corps. L'on ne saurait trop insister sur l'importance de cette lésion dans le diagnostic différérentiel avec des tumeurs osseuses, l'ostéomyélite et la thrombophlébite.

SUMARIO

As fraturas por esforço ou de marcha sobre a tibia são vistas frequentamente em pessoas robustas, adultos jovens e sadios, paryicularmente durante o treinamento dos recrutas.

O sintoma universal da dor durante a pressão e o esforço combinado com o edema deve levantar a suspeita. Depois de duas semanas a radiografia revela a existencia da lesão. O tratamento consiste de um estribo ambulatorio seguido de uma ou duas semanas de fisioterapia e movimentação ativa. A importancia do diagnostico diferencial com os tumores osseos, a osteomielite e a tromboflebite não podem ser esquecida.

RIASSUNTO

Le fratture da sforzo della tibia si osservano spesso in giovani sani e vigorosi, e particolarmente durante il servizio militare. I sintomi sono rappresentati dal dolore sotto carcico, dalla dolorabilità locale alla pressione, dall'edema; l'esame radiologico dimostra la lesione dopo un paio di settimane. La cura consiste nell'uso delle stampelle per 6 settimane, evitando ogni carico sull'arto, e poi una o due settimane di terapie fisica permettendo l'uso completo dell'arto. Non si deve sopravalutare l'importanza di questa lesione nella diagnosi differenziale con i tumori ossei, l'osteomielite e la troboflebite.

BIBLIOGRAPHY

Aleman, O.: Tidskr. i Militar Halsovard 53-54, 1929.

Breithaupt: Cited by Hullinger and Tyler, 1855.

Burrows, H. J.: Fatigue Fracture of the Middle Tibia in Ballet Dancers, J. Bone & Joint Surg. 38(b), February 1956.

Devas, M. B.: Stress Fractures of the Tibia in Athletes or "Shin Soreness," J. Bone & Joint Surg. 40 (b) 227 (May) 1958.

Genz: Periostale Auflagerung am Schienbein mit Spontanfraktur, Verofftl. Heeres-Sanwes H. 98:69-75, 1935.

Hansson, C. J.: On Insufficiency Fractures of Femur and Tibia, Acta Radiol. 19:554-559, 1938.

Hullinger, C. W., and Tyler, W. L.: March Fracture: Report of 313 Cases, Bull. U.S.A. M. Department 8:72 (Sept.) 1944.

Krause, G. R., and Thompson, J. R.: March Fractures of the Tibia, Radiology 41:580 (Dec.) 1943.

Nickerson, S. H.: March Fractures of Insufficiency Fractures, Army J. Surg. 62:154 (Nov.) 1943.

Proctor, S. E.; Campbell, T. A., and Sobelle, M.: March Fractures of the Tibia and Femur, Surg., Gynec. & Obst. 78:415 (April) 1944.

Pauzat, J. E.: De la Periostite Osteoplasique des Metatarsiens a la suite Des Marches, Arch. Med. Pharm. Mil. 10:337-358, 1887.

Ollonqvist, L. J.: Osteopathia Itineraria Tibiae, Acta Radiol. 18:526, 1937.

Roberts, S. M., and Vogt, E. C.: Pseudofractures of the Tibia, J. Bone & Joint Surg. 21:891 (Oct.) 1939.

Schinz, H. R.; Baensch, W. E.; Friedel, E., and Euhlinger, E. (edited by James T. Case): Roentgen Diagnostics, vol. 1 (Skeleton). New York: Grune and Stratton, 1951.

Wells, P. O.: March Fractures of the Tibia, Radiology 58:714-719 (May) 1952.

Wolfe, H. R., and Robertson, J. M.: Fatigue Fractures of the Femur and Tibia, Lancet 2:11-13 (July 3) 1945.

The Sick Child.—A painting of great beauty by Gabriel Metsu, which portrays the apathy and wistfulness so characteristic of the sick child. It emphasizes an important point—a child who does not show normal emotions by laughing and crying is seriously ill. (*Reproduced by courtesy of the Rijksmuseum, Amsterdam, The Netherlands.*)

—Hamilton Bailey, F.R.C.S. (Eng.), F.A.C.S., F.R.S. (Edin.), F.I.C.S. (Hon.)

Surgery of the Thyroid and Parathyroids

New Concepts in the Treatment of Carcinoma of the Thyroid

ROBERTSON WARD, M.D., F.A.C.S., F.I.C.S.

SAN FRANCISCO, CALIFORNIA

Carcinoma of the thyrcid is observed in an increasing percentage of patients operated upon for nodular goiter. Any system of selection that brings these patients to earlier operation can be expected to give increasingly good results. Early operation on children with nodular goiter, men with nontoxic nodular goiter, and all patients with discrete or solitary tumor has been effective in the author's experience. The type and extent of operation should be governed by immediate frozen section of the tissue and determination by the pathologist of the type of growth present. At the University of California School of Medicine in San Francisco, radioactive iodine has proved to be a valuable aid in locating metastases. It has also helped to some extent in the treatment of certain inoperable conditions.

MOST of the modern advances in treatment as well as in diagnosis of diseases of the thyroid are based upon the great affinity of this gland for iodine. Tremendous advances in understanding of the physiologic and pathologic aspects of the thyroid gland have been made since radioactive iodine (I^{131}) has been available for investigative purposes. During the twelve years in which radioiodine has been generally available, thyroid physiologic theories and concepts, previously impossible to demonstrate, have been elucidated. Although radioiodine has not been as successful a therapeutic agent as was predicted, its use as a tool has taught the profession much about the physiologic character of thyroid neoplasms and their hormonal stimuli.

I should like to present a composite view of those at the University of California School of Medicine in San Francisco who are treating carcinoma of the thyroid. I might point out that there is no routine diagnostic or therapeutic procedure to which all patients are subjected. This applies especially to decisions concerning treatment. The treatment decided upon is the one that is considered best for the individual patient by his individual physician. This, of course, is as it should be in the best practice of medicine.

From the Department of Surgery, University of California School of Medicine, San Francisco, California.
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It is generally conceded that carcinoma of the thyroid is primarily a surgical disease. Many do not realize that it is rapidly becoming the most important surgical disease of the thyroid gland, if not the one most frequently encountered. Figure 1 illustrates the trend at the University of

California Hospital from 1912 to 1953. It can be seen that 13.2 per cent of the nodular goiters removed in the last five-year period were malignant.

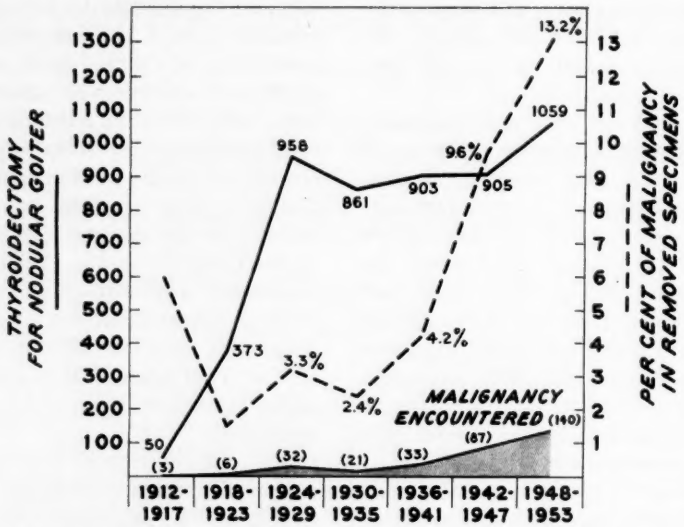
A similar trend has been noted in other parts of the country. Hayles and his co-workers[1] noted an even greater increase in the percentile incidence of malignancy in the nodular goiters of children, which rose from 4.5 per cent in 1919 to 70 per cent in the 1950s. When one realizes that fewer and fewer patients with diffuse toxic goiter are being subjected to operation, it can readily be seen that carcinoma of the thyroid and the nodular goiter with which it is associated are assuming proportionately greater importance.

In discussing the treatment of this disease it is necessary to dwell somewhat on the diagnosis as well. The earlier a malignant lesion is diagnosed, the more successful will treatment be. From the diagnostic standpoint, the presence of a nodular goiter is important. Almost all carcinomas of the thyroid are nodular. If surgeons can tell from diagnostic procedures which of the nodular goiters are likely to be malignant and then advise surgical removal of these, they will have gone a long way toward solution of the problem of malignant goiter. Varying degrees of thyroid activity, alternating with involutionary changes, have been associated with the causation of non-neoplastic nodules, both clinically and experimentally. The fact that the involutionary type of nodule is most common in the adult female is rightly attributed to the varying physiologic demands for thyroid activity associated with menstruation, childbearing, lactation and the climacteric. The thyroid becomes enlarged or undergoes hypertrophy to meet these demands, with involution when the demands diminish. This process of intermittent hypertrophy and involution commonly leads to nodulation.

There is good evidence to suggest that some nodular goiters are due to enlargement of the thyroid by hypertrophy in an attempt to meet the demand for increased production of thyroid hormone.[2] This type of thyroid enlargement should, and often does, respond to the administration of thyroid substances, or triiodothyronine, by a reduction in size or disappearance of the nodules. This type of enlargement and nodulation is due to pituitary thyroid-stimulating hormones (TSH) and is on a functional and almost physiologic basis. It is a nonsurgical condition.[3] The real diagnostic problem is the differentiation of a thyroid gland that is enlarged on this basis from one that is the site of true neoplasm.

Any thyroid gland that is the site of neoplasm immediately becomes a surgical problem. The real objective of diagnostic studies is the separation of nodular goiters into the involutional, or physiologic, and the neoplastic groups.[4] Hyperthyroidism is rarely associated with malignant tumors; therefore, the diagnostic tests that help to determine the presence or absence of hyperthyroidism also help in the elimination, to a large extent, of the probability of malignant neoplastic disease. It follows, accordingly, that tests for hyperthyroidism, such as determination of the basal metabolic rate and tests for elevated protein-bound iodine and radioactive-iodine uptake, also help to screen patients for the possibility of neoplastic change. Another test that helps in screening is a scanogram of the neck, taken after a test dose of radioactive iodine. By this method it has become possible to pick out the so-called "hot" and "cold" nodules and almost to rule out neoplastic disease in the "hot" nodules.

Like any other laboratory device, the scanogram is merely suggestive, not diagnostic. Only rarely has carcinoma been observed in areas of high iodine uptake, but frequently causes other than carcinoma have been detected for "cold" nodules. The fact that few malignant growths



YEAR	TOTAL	NODULAR GOITER	MALIGNANT	%
1954	190	164	26	13.7
1955	141	127	14	10.0
1956	155	128	27	17.4

Fig. 1.—Incidence of malignancy observed in operations for nodular goiter at the University of California Hospitals, 1912-1956.

of the thyroid are as highly functional as the surrounding, normal thyroid tissue means that a low uptake of I^{131} in the nodule is consistent with, if not indicative of, neoplasm.

In addition to testing for increased or decreased physiologic activity when decreased activity points in the direction of neoplasm, there are other aids, mainly statistical, that help to separate the benign from the malignant nodular goiters.

Analyses at the University of California Medical Center have taught my colleagues and me to suspect the presence of neoplasm in three types of patients with nodular goiter. These are (1) children with nodular goiter; (2) men with nontoxic nodular goiter, and (3) patients of any age of either sex who have solitary or discrete nodules (Fig. 2).

Regardless of the method of selection, a decision must be made at the time of operation as to whether malignancy is present and, if so, as to the extent of the surgical procedure to be carried out. As an aid in this decision and in establishing the final prognosis, malignant neoplasms of the thyroid have been divided into three general groups with different degrees of malignancy, different paths of invasion, different life histories and different prognoses.

The first of these is papillary carcinoma, which tends to spread by lymphatic invasion. The second is alveolar or follicular carcinoma, which tends to spread by vascular and local invasion. The third is anaplastic or undifferentiated carcinoma, which tends to spread by all methods but is particularly infiltrative locally.

To select the correct surgical procedure, it is necessary to have a frozen section made and then to hold an immediate pathologic consultation in order to decide, first, whether malignancy is actually present, and second, the type of malignancy.

There are obvious disagreements throughout the world and on almost every every hospital staff about what the treatment should be once the diagnosis of malignant goiter is established. It seems to me that the basis of this disagreement is whether papillary carcinoma of the thyroid should be considered less malignant than other forms. If one is convinced of this, as I am, there is justification for less radical procedures for this type of carcinoma. If, on the other hand, one is convinced that all carcinomas of the thyroid are equally malignant, there is justification for the stand taken by Hayes Martin,[5] McCorkle[6] and others, that a homolateral neck dissection should accompany each lobectomy for carcinoma of the thyroid.

If all carcinomas of the thyroid are of equal malignancy and spread equally by the same pathways, it would be consistent with Halsted's dictum for carcinoma of the breast to perform bilateral total lobectomy, bilateral radical neck dissection and mediastinal dissection in every case. Obviously such an operation would be in the same class as ultraradical mastectomy, which includes mediastinal and supraclavicular dissections in each case.

I think it is fair to say that the majority of surgeons at the University of California Medical Center are of the opinion that papillary carcinoma is less malignant than other forms. A study of 293 cases of carcinoma of the thyroid made at this institution showed that carcinoma arising in one lobe involved the other lobe in 30 per cent of the papillary tumors, 25 per cent of the follicular and 60 per cent of the undifferentiated growths.[7] For this reason there is general agreement that total thyroidectomy is indicated when any type of carcinoma is discovered by frozen section. Early in the operation, the observation of a delphian node near the isthmus may give a clue to the extent of operation necessary. If this node is enlarged owing to the presence of carcinoma, the least radical procedure by which one can look forward to a cure is total thyroidectomy.

If the node is not involved and if the tumor is solitary, the operation should consist of a total lobectomy on the affected side. If the tumor is benign, total lobectomy is sufficient. If the pathologist reports papillary adenocarcinoma, a total thyroidectomy should be done and a search should be made for regional involvement of the lymph nodes. If enlarged nodes are present, a neck dissection on the side bearing the tumor should be included in the original operation.

If the pathologist reports alveolar carcinoma, it is sometimes justifiable to perform a total thyroidectomy and to omit the neck dissection. If an anaplastic or undifferentiated carcinoma is present, it is questionable whether performing more than radical removal of the involved area

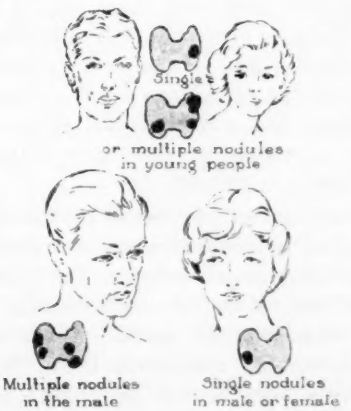


Fig. 2.—Types of patient in whom malignant goiter should be suspected when nodular goiter is present.

is justified. For this type of carcinoma, neck dissection is seldom indicated.

Total thyroidectomy is recommended when the pathologist reports the presence of follicular or alveolar carcinoma in the frozen section; this tumor has a pronounced tendency to spread by vascular invasion and to produce distant mestastases. In order that the mestastases may be located and treated with radioactive iodine, all functioning thyroid tissue should be removed surgically from the neck.[8]

Decisions concerning the further treatment of carcinoma are based to a great extent on the type of carcinoma observed on pathologic examination. If the tumor is predominantly papillary and there is a question in the surgeon's mind whether there is unremoved malignant tissue, postoperative external radiation therapy is indicated. Many patients so treated have remained well for many years and have had no local recurrence.

As I pointed out previously, external radiation therapy is not a routine procedure. It is the consensus here that its principal value is in the treatment of the aforementioned type of lesion, and occasionally for the patient who has inoperable deposits in the neck and distant bony metastases, and that there should be no such thing as prophylactic irradiation. Our radiologists are unwilling to expose patients to the very large doses of radiation necessary for a carcinocidal effect unless there is reasonable assurance that viable carcinoma is present.

Treatment of carcinoma of the thyroid with radioactive iodine has been done here on a highly selective basis. The prime requirement, of course, for successful therapy depends upon uptake of radioactive iodine by the malignant tissue in such amounts that it can be therapeutically effective. Function is approximately related to the histologic character of the tumor and has been observed to a high degree most frequently in follicular tumors. Papillary tumors rank next in their affinity for I^{131}; there is little uptake in the undifferentiated anaplastic growths. To increase the function of carcinomatous tissue, removal of all normal thyroid tissue is the first step. If this has not been done by an operative procedure, it can be accomplished by a therapeutic dose of I^{131}.

Administration of exogenous thyroid-stimulating hormones is the second step, and the third is the use of thiouracil derivatives. It should be remembered that the beta radiations from radioiodine have a therapeutic effect through only 2 mm. of tissue. It is necessary, therefore, to get not only a considerable concentration but a fairly uniform distribution of radioiodine into the tissues of the tumor for it to be effective.

Some degree of arrest or regression of the disease was achieved in 11 of 23 radioiodine-treated patients observed from 1938 to 1954.[9] Of these, 4 patients were alive in May 1957. One of them is known to have carcinoma; the others are apparently well. This is not an over-encouraging set of results. An additional 62 patients with residual carcinoma were studied during this time but were not suitable for radioiodine therapy.

There is another therapeutic measure that we believe to have great value, particularly for young patients. It has been our practice to give tolerance doses of thyroid substance to these young persons. This was done empirically many years ago by Sir Thomas Dunhill.[10] In recent years there has been much evidence to suggest that the beneficial effect so obtained is due to suppression of the production of thyroid-stimulating hormones by the pituitary gland. Whether thyroid-stimulating hormones play the same part in promotion and continuation of growth of carcinoma

as in the production of thyroid hormone has yet to be demonstrated. Certainly the recent studies of Thomas,[11] in which triiodothyronine was used in cases of far advanced malignancy, lends encouragement to this point of view, as showing that not all carcinomas are dependent on these hormones. In some cases observed here, suppression of thyroid-stimulating hormones has been of undoubted benefit.

SUMMARY

Carcinoma of the thyroid is being observed in an increasing percentage of patients operated upon for nodular goiter. Any system of selection that brings these patients to earlier operation can be expected to give increasingly good results. Early operation on children with nodular goiter, men with nontoxic nodular goiter, and all patients with discrete or solitary tumor has been effective in the author's experience. Finally, the type and extent of operation should be governed by immediate frozen section of the tissue and determination by the pathologist of the type of growth present. For papillary carcinoma, a total thyroidectomy and homolateral neck dissection are recommended. For alveolar carcinoma, total thyroidectomy is recommended. For anaplastic carcinoma, radical local resection is the treatment of choice. In certain cases, especially those in which the growth is predominantly papillary, external irradiation is recommended.

The author has found radioactive iodine a valuable instrument for locating metastatic deposits and of some help in treating certain inoperable conditions.

RIASSUNTO

Il carcinoma della tiroide viene osservato con sempre maggior frequenza in pazienti operati per gozzo nodulare. Ogni tentativo diretto a condurre questi malati all'operazione il più precocemente possibile è destinato a migliorare i risultati finali. Secondo l'esperienza dell'autore si dimostra efficace qualunque intervento eseguito precocemente su bambini con gozzo nodulare, su adulti con gozzo nodulare non tossico e su qualunque paziente con gozzo di modeste proporzioni o solitario. Il tipo e la estensione de dare all'intervento dovrà essere stabilito da un esame istologico eseguito immediatamente al congelatore; nel carcinoma papillifero si dovrà eseguire la tiroidectomia totale con dissezione omolaterale del collo; nel carcinoma alveolare la tiroidectomia totale; nel carcinoma alveolare la tiroidectomie totale; nel carcinoma anaplastico la resezione locale radicale. In certi casi, specie in quelli in cui il tumore è prevalentemente papillifero, si raccomanda l'irradiazione.

L'autore ritiene che l'uso dello jodio radioattivo sia molto utile per localizzare le metastasi e in qualche caso possa giovare nella terapia delle forme inoperabili.

RÉSUMÉ

La carcinome de la thyroïde se rencontre dans un pourcentage croissant de cas opérés de goître nodulaire. Toute méthode de sélection amenant ces malades à une opération plus précoce peut donner des résultats de plus en plus satisfaisants. L'auteur a constaté que l'opération précoce était efficace chez les enfants atteints de goître nodulaire, chez les adultes à goître nodulaire non toxique, et chez tous les malades à tumeur discrète ou solitaire. Enfin, le type et l'étendue de l'opération devraient être dictés par une coupe à la congélation extemporanée soumise immédiatement au diagnostic de l'anatomopathologiste. Pour le carcinome papillaire, une thyroidectomie totale avec dissection homolatérale du cou est recommandée. Pour le carcinome alvéolaire, une thyroidectomie totale est indiquée. Pour le carcinome anaplasique, la résection locale radicale est le traitement de choix. Dans

certains cas, en particulier quand la tumeur est à prédominance papillaire, une irradiation externe est conseillée.

L'auteur estime que l'iode radio-actif est une aide précieuse pour la localisation de formations métastatiques, et d'un certain secours dans le traitement de certains cas inopérables.

ZUSAMMENFASSUNG

Bei Patienten, die wegen eines knotigen Kropfes operiert werden, wird ein Schilddrüsenkrebs in ständig wachsendem Prozentsatz beobachtet. Jedes System der Auswahl, das zu einer frühzeitigeren Operation dieser Kranken führt, kann erwartungsgemäss zu einer zunehmenden Verbesserung der Resultate führen. In der Erfahrung des Verfassers hat sich der frühzeitige chirurgische Eingriff bei Kindern mit knotigem Kropf, bei Männern mit nichttoxischem knotigem Kropf und bei allen Kranken mit umschriebenen oder solitären Geschwülstein als wirksam erwiesen. Die Art und Ausdehnung des Eingriffes sollte von den Ergebnissen eines sofortigen Gefrierschnittes des Gewebes und von der Klassifizierung der vorliegenden Geschwülst durch den Pathologen abhängig gemacht werden. Für Fälle von papillärem Krebs wird die Totalresektion der Schilddrüse mit Resektion der Halsweichteile der erkrankten Seite, für Fälle von alveolärem Krebs die totale Schilddrüsenresektion empfohlen. Beim anaplastischen Krebs ist eine radikale örtliche Resektion das Verfahren der Wahl. In gewissen Fällen, besonders wenn es sich um eine vorwiegend papilläre Geschwulst handelt, wird externe Bestrahlung empfohlen.

Das radioaktive Jod hat sich dem Verfasser zur Lokalisierung von Metastasen und in der Behandliung gewisser inoperabler Fälle als wertvoll erwiesen.

SUMARIO

A incidencia de carcinoma da tireóide vem sendo observada em maior porcentagem de doentes operados por bocio nodular. Qualquer sistema que leve essas pessoas a operação precoce fornece melhores resultados Nas crianças com bocio nodular, nos adultos com bocio nodular atoxico ou em qualquer caso de tumor discreto ou isolado, a operação precoce tem sido grata ao A. O tipo e extensão da operação devem ser orien tados pela biopsia e histopatologia. Nos carcinomas papilares a tireoidectomia total com dissecção cervical homolateral são aconselhadas. No carcinoma alveolar a resecção radical é o tratamento de escolha. Recomendam a irradiação nos casos em que a neoformação é predominantemente papilar. Considera o iodo radioativo muito útil para localização de depositos metastaticos e de algum auxiliono tratamento de certas formas inoperaveis.

RESUMEN

Entre los enfermos operados de bocio nodular la confirmación de que se trata de un carcinoma tiroideo resulta aparecer en un porcentaje creciente. Se obtendrán resultados tanto mejores cuando se dé con la forma de que dichos enfermos acudan a la cirurgía lo antes posible. De acuerdo con la experiencia del autor se han mostrado altamente eficaces las operaciones precoces en niños con bocio nodular, en adultos con adenoma nodular no tóxico y en todos los enfermos con nódulo discreto solitario. La operación debe completarse siempre con el estudio inmediato microscópico de la pieza por congelación. En el caso de carcinoma papilar debe practicarse la tiroidectomía radical con disección bilateral del cuello. En el caso de carcinoma anaplástico el tratamiento de elección es la resección local radical. En el caso de

carcinoma alveolar se recomienda la tiroidectomía total. En cietos casos, especialmente si el tumor es predominantemente papilar se recomienda la radiación externa. El autor considera el yodo radioactivo como excelente para localizar las metástasis y útil en el tratamiento de algunos casos inoperabels.

REFERENCES

1. Hayles, A. B.; Kennedy, R. L. J.: Woolner, L. B., and Black, B. M.: Nodular Lesions of the Thyroid Gland in Children, J. Clin. Endocrinol. & Metab. **16**:1580-1594, 1956.

2. Starr, P., and Goodwin, W.: Use of Triiodothyronine for Reduction of Goiter and Detection of Thyroid Cancer, Metabolism **7**:287-292, 1958.

3. Skillern, P. G.; Crile, G.; McCullagh, E. P.; Hazard, J. B.; Lewis, L. A., and Brown, H.: Struma Lymphomatosa; Primary Thyroid Failure with Compensatory Thyroid Enlargement, J. Clin. Endocrinol. & Metab. **16**:35-54, 1956.

4. Miller, J. M.; Block, M. A., and Brush, B. E.: The Selection of Patients for Thyroid Preventive Surgery, Tr. Am. Goiter Assn. 434-442, 1956.

5. Martin, H.: The Surgery of Thyroid Tumors, Cancer **7**:1063-1099, 1954.

6. McCorkle, H. J.: The Surgical Removal of Metastatic Malignant Disease of the Thyroid Gland from the Anterior-Superior Mediastinum, Am. J. Surg. **94**:217-222, 1957.

7. McCorkle, H. J., in discussion of Chester, S. T.: The Surgical Treatment of Carcinoma of the Thyroid, Am. J. Surg. **96**:272-280, 1958.

8. Maloof, F.; Vickery, A. L., and Rapp, B.: An Evaluation of Various Factors Influencing the Treatment of Metastatic Thyroid Carcinoma with I^{131}, J. Clin. Endocrinol. & Metab. **16**:1-27, 1956.

9. Sheline, G. E., and Miller, E. R.: Studies with Radioiodine. VI. Evaluation of Radioiodine Treatment of Carcinoma of the Thyroid Based on the Experience at the University of California from 1938 to 1954, Radiology **69**:527-545, 1957.

10. Dunhill, T.: The Surgery of the Thyroid Gland. Lettsomian Lectures, Tr. M. Soc. London **60**:234-282, 1937.

11. Thomas, C. G.: Hormonal Treatment of Thyroid Cancer, J. Clin. Endocrinol. & Metab. **17**:232-237, 1957.

12. Thomas, C. G.: The Use of L-Tri-iodothyronine as a Pituitary Depressant in the Management of Thyroid Cancer, Surg., Gynec. & Obst. **106**:137-144, 1958.

I would stress the value and importance, under certain conditions, of delay in diagnosis, or, to make my meaning more clear, delay in applying a label. We must, for the sake of our souls, diagnose every case which we have had the opportunity to examine conscientiously. Such a diagnosis may be provisional, that is, we believe it to be as near the truth as the facts at our disposal will allow, but it must be a definite one in our minds, and not one of many alternatives. It is better to be certain than to be right, for men may rise on stepping stones of their dead diagnoses to higher things, but from the complacent swamp of vague alternatives no ascent is possible. On the other hand a diagnostic label, once applied to a case, is apt to stick to it permanently, to bias all further investigations concerning it, and to govern its treatment.

—Ogilvie

Section en Francais

Les Complications Urinaires de l'Operation de Meigs

(Urinary Complications of the Meigs Operation)

J. MAGENDIE, M.D., F.I.C.S., J. BALLANGER, M.D., F.I.C.S.,
M. REGNIER, M.D., F.I.C.S., J. MAGIMEL, M.D., ET X. PONSAN, M.D.
BORDEAUX, FRANCE

NOUS avons réalisé une quarantaine de *curages cellulo-lymphatiques associés le plus souvent à une hystérectomie élargie de Wertheim.* La technique que nous avons suivie s'inspire directement de l'opération de Meigs.

Mais *chaque fois, nous l'avons fait précéder d'une curiethérapie* effectuée quelques mois auparavant et parfois suivie de radiothérapie complémentaire.

Dans le décours immédiat ou plus ou moins tardivement après l'opération, nous avons observé des *complications urinaires, tantôt bénignes, tantôt sérieuses* ayant nécessité des opération ultérieures:

2 sutures primitives de l'uretère (l'une guérie d'emblée, l'autre après plastie urétérale).

1 opération de Coffey dans un mauvais cas, trop avancé, et qui s'est mal terminée.

2 néphrectomies, une suivie de guérison, une ayant précédé de peu la généralisation.

2 opérations de plastie avec lambeau vésical selon la technique de Boari pour fistule sténose, suivies de guérison.

Nous classons ces observations de la façon suivante.

4 *complications mineures ou bénignes:*

Complications referable to the urinary tract and associated with Meigs' operation are classified as minor and serious, and examples of each are cited. Among the minor complications are cystitis and pyelonephritis; among the major ones, accidental section of the ureter, fistula, stenosis and radionecrosis. It is not attempted to describe in detail the curative treatment of all serious complications in this field, but the authors wish to mention the value of Boari's procedure, which enables the surgeon to ward off infection and sclerosis and enables him to perform a ureteral plasty easily and efficiently with the aid of a vesical flap. They have achieved success with this procedure in the 3 cases in which they have employed it and recommend that it be performed, if possible, at an early stage, when no distention and no old renal infection exists to complicate it.

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cystites, pyélonéphrites sans dilatation ou avec légère dilatation transitoire.

9 *complication sérieuses* parmi lesquelles:

2 *évitables, dûes à une faute opératoire* (section accidentelle de l'uretère).

3 *complications de radionécrose tardive* et qui empruntent leur gravité au fait qu'elles ne sont que la première manifestation de la récidive précédant de peu la généralisation.

4 *complications* de fistules ou sténoses relativement précoces qui posent véritablement le problème de la pathogénie et de la prophylaxie et qui sont de beaucoup les plus intéressantes.

I—COMPLICATIONS MINEURES OU BÉNIGNES (4 CAS)

Ce sont des troubles fonctionnels légers, liés à une dyskinésie passagère associée à une infection rapidement guérie *s'il n'y a pas de cause anatomique* pour l'entretenir.

Observation 34: Mme B. . . , 33 ans, au 9° jour après l'opération de Meigs, douleurs au niveau du rein droit. Pas de signes urinaires, urographie normale contrôlée quelques mois après.

Observation 26: Mme P. . . , 41 ans, poussées de colibacillose dans les suites opératoires immédiates. L'urographie est normale et restera normale à la vérification ultérieure.

Observation 23: Mme P. . . , 33 ans, poussée de pyélo néphrite au moment où la malade allait quitter le Service, 20 jours après l'opération. Elle avait déjà fait une colibacillose au cours d'une grossesse antérieure. Pas de dilatation des cavités pyélo calicielles à la radiographie.

Par contre, si déjà existaient des *lésions anatomiques prédisposantes,* l'infection est plus sévère et plus durable:

Observation 18: Mme D. . . , 34 ans, depuis l'opération de Meigs, troubles urinaires: incontinence légère à l'effort et douleurs dans la fosse lombaire droite.

Urographie: Légère distension du bassinet droit et présence d'un petit siphon urétéral Traitement par antibiotiques.

Quelques mois après les cavités ont repris leur volume normal, mais l'infection à colibacilles persiste. Instillations vésicales et lavages du bassinet. Amélioration en cours.

II—COMPLICATIONS MAJEURES OU SÉRIEUSES (9 CAS)

I°) Mettons d'abord à part deux cas que nous considérons comme des *complications évitables: il s'agit de deux sections accidentelles de l'uretère par faute opératoire.*

Observation 32: Mme E. . . , 44 ans, section basse de l'uretère gauche à 6 cm de la vessie en fendant le péritoine de la pointe des ciseaux de Mayo d'une façon trop assurée dans un cas où le radium l'avait épaissi et intimement collé dans la profondeur.

Suture en fin d'opération sur tube de polythène.

Fistule au 16° jour et distension pyélocalicielle secondaire.

Opération de plastie avec lambeau vésical selon Boari trois mois et demi après.

Guérison de la fistule.

Regression progressive de la dilatation qui a presque disparu cinq mois après.

Observation 33: Mme G. . . , 46 ans, section accidentelle haute de l'uretère droit au croisement des vaisseaux iliaques primitifs par suite de mauvaise visibilité dans un bassin profond et étroit chez une malade saignant beaucoup par troubles de la crase sanguine. Suture en fin d'intervention sur tube de polythène dans les mêmes conditions que précédemment. Cicatrisation sans fistule.

Pendant 2 mois, persistance d'une très légère hydro-néphrose bilatérale, un peu plus marquée du côté blessé. Guérison complète.

Noter la différence d'évolution de ces

deux blessures de l'uretère suivant le niveau. *La zone critique pour la vitalité de l'uretère est bien celle de l'uretère paramétrial.*

Ces deux sections urétérales sont survenues non pas au début de notre expérience mais après plus de 30 opérations.

Nous pensons cependant les éviter dorénavant:

1°) en prenant plus de précautions dans la dissection du péritoine toujours accollé à l'uretère, mais parfois intimement lié à lui par la réaction fibreuse.

2°) en repérant les uretères d'emblée par un fil de catgut dès les premiers temps de l'opération.

2°) Voici maintenant *trois cas de radionécrose tardive que ont été les premiers signes d'une récidive locale avant généralisation:*

Observation 13: Mme I. . . , 29 ans, deux ans et 9 mois après l'opération de Meigs se plaint de troubles vésicaux. A la cystoscopie on trouve une petite ulcération qui est interprê tée d'abord comme une radio nécrose tardive car l'état général de la malade est parfait.

Maleureusement apparait bientôt un oedème du membre inférieur et de la région sus pubienne.

4 mois après, amaigrissement et hémoptysie. Les métastases pulmonaires se précisent, bientôt suives de métastases hépatiques, puis cérébrales qui emportent la malade I an après le début des troubles.

Observation 11: Mme E. . . , 43 ans, fistule vésico vaginale survenue *trois mois après* une opération de Meigs dans un cas extrémement avancé (basofilie cellulaire au stade III). La dissection des paramètres avait eu lieu en pleins tissus suspects. On eut dû faire une totale et non un Meigs dans ce cas.

Le vagin n'avait pas cicatrisé et etait resté bourgeonnant et sanieux.

Opération: Implantation des uretères dans la sigmoïde selon la technique de Coffey. Poussées d'infection et d'hyper azotémie. Décés 2 ans après en pleine généralisation.

Observation 0: Mme V. . . , 43 ans. Deux mois après une opération de Wertheim sans lymphadénectomie, apparition de fièvre, de frissons et d'anorexie puis fistule urétéro vaginale droite.

Le fond du vagin est sphacélique.

Poussées infectieuses avec gros rein dont la valeur fonctionnelle devient très précaire Néphrectomie.

Un an environ après, signes de récidive et de généralisation. Décés.

Ces trois observations sont sans grand intérêt au point de vue de la discussion pathogénique. Comme d'habitude c'est une association de radio nécrose et de récidive qui est à l'origine des lésions.

La chirurgie ne saurait être mise en cause, étant donnée l'apparition tardive des complications.

3°) Les 4 observations suivantes ont *trait à des sténoses ou à des fistules urétérales plus ou moins précoces, isolées ou associées.*

Nous les considérons jusqu'ici comme *inévitables.* Ce sont elles dont nous voudrions connaître la pathogénie exacte pour arriver à une utile prophylaxie.

A STÉNOSES ISOLÉES SANS FISTULE:

Sténose précoce avec hydro-néphrose infectée bilatérale, guérison médicale.

Observation 35: Mme C. . . , 45 ans, phlébite post opératoire au 7e jour de l'opération de Meigs traitée par Héparine et Tromexane. Le lendemain, lipothymie, hémorragie vaginale profuse. Gonflement et tension des fosses iliaques, surtout de la gauche: *hématome probable dans l'espace pelvien cloisonné par l'opération.*

Les jours suivants, fièvre, urines troubles, puis crises douloureuses lombaires droites. Petite réaction pyélique droite. Sonde à demeure, Cortancyl, antibiotiques.

I mois ½ après, l'hydro-néphrose droite a beaucoup regressé; il persiste une légère hydro-néphrose gauche.

On saisit ici sur le vif le *rôle de l'épanchement lympho-hématique infecté post opératoire entourant l'uretère,* sur lequel on n'a pas jusqu'ici suffisamment à notre avis attiré l'attention.

Sténose tardive avec exclusion du rein, nécessitant la néphrectomie.

Observation 19: Mme L. . . , 32 ans, *le radium a donné une réaction extrémement vive* avec colpite très suintante qui a obobligé à retarder d'un mois l'intervention.

Au cours de l'opération de Meigs, la malade n'a pas saigné de façon notable. Elle a quitté l'Hopital en bon état vers le 20° jour.

Mais quelques semaines après, pyélonéphrite droite traitée par son médecin de façon banale. Revient deux mois après l'opération avec un gros rein droit distendu, douloureux, infecté, dont l'élimination est nulle. Elle refuse toute intervention et se soigne médicalement. Revient au bout de deux mois sans infection ni douleur, mais avec un rein droit exclu qui n'est pas visible à l'uro-sélectan.

L'opération montre un uretère dilaté de la dimension du pouce. Au point de croisement des vaisseaux il se rétrécit et se transforme en un cordon scléreux, plein, sans lumiére. Sa muqueuse a disparu. Il est soudé aux parois pelviennes par une gangue fibreuse et comme cartilagineuse par places, indissécable. Les lésions augmentent à mesure qu'on se rapproche de la corne vésicale. Urétérostomie cutanée: le rein ne concentre plus et doit être considéré comme perdu. Néphrectomie. Guérison.

Cette sténose grave suivie de l'exclusion du rein qui sïinfecte et meurt ne saurait être dûe à une coudure de l'uretère per opératoire par une ligature. Mais *deux hypothèses pathogéniques* sont également plausibles et doivent être retenues:

Ici *l'hématome post opératoire* a pu jouer un rôle, mais non évident.

Il faut surtout pour expliquer la transformation de l'uretère en un cordon plein, faire intervenir *l'infection urétérale et péri urétérale,* et surtout *la nécrose partielle de l'uretère aboutissant à la destruction de la muqueuse et à la sclérose des parois.*

B STÉNOSES AVEC FISTULE:

Voici maintenant deux observations où se trouvaient associées à la fois *une sténose et une fistule précoce,* guéries par une opération de Boari.

Observation 37: Mme D. . . , 48 ans. Hémogénique fruste. A beaucoup saigné pendant son opération de Meigs. Le 9° jour, elle souffre un peu du rein droit. Urographie systématique: il existe déjà une nette hydro-néphrose. Cathétérisme urétéral; la sonde bute à 4 cm: cortisone et antibiotiques. Le 15° jour, émission d'urines sanglantes par le vagin. L'écoulement se tarit les jours suivants.

Le 25° jour, la température monte à 39°, puis 40. On opère aussitôt: l'uretère est extrêmement épaissi et sténosé dans un foyer inflammatoire hématique à odeur fétide, situé près de la corne vésicale: opération de Boari (plastie avec lambeau vésical). Suites fébriles pendant quelques jours, puis guérison. Disparition progressive de l'hydro néphrose.

Le mécanisme de cette complication a associé vraisemblablement: l'hématome infecté chez cette hémogénique fruste et la dévitalisation de l'uretère déjà altéré par les radiations.

Il semble qu'ici *nous ayons pu dissocier grâce à la précocité de l'intervention l'altération pariétale de l'uretère* (phénomène primitif) et *l'engainement dans la sclérose périphérique dûe à l'organisation de l'hématome infecté,* phénomène secondaire qui ici n'a pas eu le temps d'apparaître comme dans l'observation précédente.

Observation 28: Mme B. . . , 43 ans, avait également un sang poisseux et coagulant mal, elle a beaucoup saigné pendant son opération de Meigs. Les suites furent d'abord orageuses: syndrome cholériforme, obligeant à suspendre les antibiotiques. Nécessité de transfusions répétées. Le 9° jour, fièvre. Le 13°, écoulement d'urines par le vagin. Hydronéphrose droite déjà marquée et légère distension à gauche. La cystoscopie montre des urines purulentes venant par l'orifice urétéral droit. La sonde bute à I cm ½ sur un obstacle infranchissable.

Réintervention I mois après l'intervention de Meigs. L'uretère dilaté de 1 cm de diamètre s'engage au niveau du croisement des vaisseaux iliaques primitifs dans un défilé fibreux. On voit sourdre quelques gouttes d'urines purulentes. Opération de Boari, guérison. 5 mois après les cavités rénales sont redevenues sensiblement normales.

Cette observation est du même type que la précédente mais la fistule a été encore plus précoce et *l'élément obstructif, bien que présent, est passé au second plan* L'opération de Boari a également guéri la malade. Il faut noter *l'intérêt de cette intervention précoce* qui a trouvé des lésions jeunes beaucoup plus facilement curables.

ETIOLOGIE

Fréquence:

Nous avons observé 9 complications sérieuses sur 39 cas, soit 23 p. 100. Notre pourcentage s'inscrit en place intermédiaire entre la belle statistique de Meigs 473 cas avec 10,9 p. 100, celle de Popovici—(de Bucarest) 31 cas avec 29 p. 100 de complications urinaires sérieuses, et celle de Martin, Pasquier et Campbell: 30 p. 100.

Par rapport au stade du néoplasme:

Les complications bénignes sont toutes survenues dans des stades de début. Les complications sérieuses sont par contre beaucoup plus fréquentes dans les stades avancés comme le montre le tableau suivant:

	Stade I (17 cas)	Stade II (13 cas)	Stade III (9 cas)
4 complications bénignes	2 (11%)	2 (14%)	0
9 complications sérieuses	2 (22%)	3 (33%)	4 (44%)

Conditions du traitement radiothérapique préalable:

Nous avons dans tous ces cas fait dans le premier temps une curiethérapie classique à façon de Regaud: 5 tubes de bromure de radium de 10 mgr répartis dans la cavité cervico-utérine et dans les culs de sac, soigneusement maintenus par un colpostat spécial de Wangermez, pendant 7 jours consécutifs. Un méchage soigneux bourre le vagin pour éloigner vessie et rectum.

Dans certains cas une radiothérapie complémentaire a été faite avant l'opération (30 à 40 séances). Cette radiothérapie n'a coïncidé qu'une seule fois sur nos huit observations avec une complication urinaire sérieuse. *On ne saurait donc mettre en cause ce complément radiothérapique à l'origine des troubles observés.*

Rôle du delai écoulé entre l'application de radium et l'opération chirurgicale de Meigs:

Ce délai que nous tendons à raccourcir maintenant et à porter à 1 mois ½ ou 2 mois, a parfois varié suivant des circonstances diverses avec comme date extrême 1 mois ½ ou 7 mois. Il ne nous a pas semblé que la variation de ce délai ait eu une influence sur les complications urinaires.

Voici le tableau que nous avons dressé en supprimant évidemment les deux cas de blessure accidentelle de l'uretère qui n'ont aucune raison d'y figurer:

Délais pour les complications bénignes	3 mois 3 mois 3 mois 3 mois
Délais pour les complications malignes	4 mois 4 mois 3 mois ½ 2 mois ¾ 3 mois ½ 2 mois 3 mois ½

Conditions du traitement chirurgical:

Le premier geste opératoire au cours de la laparotomie doit être l'exploration manuelle des paramètres. La première condition en effet pour pouvoir faire une dissection correcte est de les trouver souples ou tout au moins assouplis par la curiethérapie de façon secondaire.

Plutôt que de faire une dissection dangereuse et inutile, mieux vaut en effet si les paramètres sont indurés, faire une simple hystérectomie totale et même si l'utérus est absolument fixé et bloqué, une simple annexectomie en associant toujours bien entendu le curage cellulo-lymphatique.

Celui-ci n'est d'ailleurs pas possible dans tous les cas.

Sur 39 cas, nous avons dû reculer une fois dans un hémi-bassin gauche: le curage du côte droit avait été parfaitement possible, à gauche au contraire, il existait une induration cartilagineuse et un péritoine absolument collé, indissécable dans la profondeur. Cette malade qui avait eu un radium très longtemps avant (7 mois) avait fait aussi une pyélo urétérite gauche et l'action de cette inflammation s'était surajoutée à celle du radium pour déterminer les lésions constatées.

Voici le tableau indiquant dans nos 39 observations la technique qui fut suivie au point de vue opératoire.

Il faut noter que tous les cas de complications urinaires se sont montrés après opération de Meigs, sauf un seul après opération de Wertheim.

C'est logique car *c'est beaucoup plus la dissection des uretères que le curage cellulo-lymphatique qui peut jouer un rôle dans l'apparition de ces complications.*

Nombre total d'opérations: 39		Complications urinaires
Opération de Meigs (Wertheim + lymphadénectomie)	31 cas	4 + 9
Opération de Meigs incomplète (unilatérale)	1 cas	0
Opération de Wertheim sans lymphadénectomie	1 cas	0
Hystérectomie totale + lymphadénectomie	4 cas	0
Annexectomie bilatérale + lymphadénectomie	2 cas	0

Technique opératoire:

Nous sommes arrivés à une technique très voisine de celle de Brenier (de Grenoble) et dérivée également de la technique initials de Meigs. Au cours de l'intervention les uretères sont disséqués sur toute leur étendue pelvienne.

Nous ne conservons pas de languette péritonéale à leur surface. Celà nous a paru inutile car la vascularisation apportée par le péritoine est insignifiante et nous préféons faire l'ablation de tout le péritoine pelvien à la façon de Brunswick.

Nous ne conservons pas non plus la petite artère que Meigs conseille de garder, venant de l'hypogastrique aussitôt après le croisement des vaisseaux. C'est difficile et ce n'est pas dans cet endroit que l'uretère risque d'être dévitalisé.

Le *point critique pour la vitalité urétérale est la traversée du paramètre latéral* La dissection doit passer au ras de l'uretère pour enlever au maximum le tissu cellulaire suspect. A ce niveau, il y a une série de petits vaisseaux courts qui viennent de l'utérine et qu'on sectionne et lie très près de l'uretère.

Bien entendu l'électro coagulation est dangereuse et doit être tout àfait proscrite à ce niveau.

Mais quelles que soient les précautions

opératoires, l'uretère est privé d'une grande partie de sa vascularisation à ce niveau.

Nous conservons cependant l'artère ombilico-vésicale et nous ne faisons jamais la ligature préventive de l'hypogastrique ou du tronc pelvien de celle-ci.

Le *drainage* du pelvis cruenté est un problème difficile à résoudre. Il est cependant essentiel pour éviter l'hématome infecté entourant les uretères dénudés. Laisser le vagin béant ne suffit pas. Nous essayons actuellement le drainage avec aspiration.

Il y a aussi des *circonstances anatomiques* qui favorisent la complication. Certaines malades ont des uretères flasques et qui pendent verticalement de la corne vésicale. D'autres, ont un uretère tendu qui s'éloigne de la paroi et on se demande comment se comblera ce vaste intervalle cruenté qui l'entoure.

Enfin, nous avons été frappés par le fait que *toutes les complications majeures ont siégé du côté droit.* Or il est certain que le côte droit est beaucoup plus large que le gauche et que l'uretère après dissection s'y trouve beaucoup plus éloigné de la paroi que du côté opposé.

CONCLUSIONS PATHOGENIQUES

1°) *Pour les complications bénignes:* dilatations pyélo-urétérales passagères, hydro-néphroses réversibles, on peut supposer une action reflexe ou un trouble de l'innervation à l'origine de cette "dyskinésie."

Mais à partir du moment où la dilatation devient *durable quoique réversible,* il peut s'associer un élément mécanique de compression urétérale par péri-urétérite (oedème des parois, compression par un hématome se résorbant progressivement et sans séquelles).

2°) *Pour les complications sérieuses:* Deux éléments pathogéniques sont mis en valeur par les différentes observations: la *péri-urétérite* et la *nécrose de l'uretére.*

I *La péri urétérite:*

a) En premier lieu, ce sont les radiations qui la déterminent. Tous les auteurs ont observé comme nous, ce *bassin "gelé"* (Dargent), cette "carapace," ce "blindage" (Cibert), cette gangue scléreuse et presque cartilagineuse qui noie l'uretère, fait adhérer le péritoine à un tissu cellulaire densifié, au point que tout dissection, tout clivage, sont impossibles.

b) Mais nous avons mis en lumière dans notre observation 35, *le rôle de l'hématome infecté* dans lequel baigne l'uretère et qui secondairement se densifie, se sclérose à son tour.

c) Insistons aussi sur une *troisième cause, infectieuse, l'urétéro pyélite à colibacilles.* Son action est très nette dans notre observation 30, où seul le côté qui fut atteint de pyélo urétérite présentait des lésions de bassin "gelé" indissécable.

II *La nécrose de l'uretère:*

a) L'existence de complications urinaires de même type, presque aussi fréquente dans la pratique des chirurgiens qui font d'emblée la cure chirurgicale sans radium préalable (Prof. Roux de Montpellier) affirme la *responsabilité de l'acte chirurgical dans cette nécrose par ischémie.*

b) *L'action propre du radium* est également des plus nettement prouvées (cas de fistules consécutives à des curiethérapies isolées (Leger). La sommation des deux causes de dévitalisation pourra aboutir à *un processus nécrotique et sténosant à marche rapide:* il semble s'annoncer dès le 4° ou 5° jour par la sténose (peut être gonflement oedémateux de l'uretère?), la douleur du rein, la distension légère du bassinet. Puis entre le 9° et le 15° jour, apparait la fistule, tandis que se précise la sténose associée (obs. 28 et 37).

Dans d'autres cas, la *nécrose est plus*

légère et aboutit à la destruction de la muqueuse et à l'oblitération de l'uretère, remplacé par un cordon scléreux (obs. 19). Ce sont les *processus progressifs, sténosants, à marche lente* pour lesquels s'associe vraisemblablement le rôle de la péri urétérite.

c) Reste enfin *l'envahissement par la récidive néoplasique* de ces tissus en partie dévitalisés. Dans les radio-nécroses tardives, il est difficile de démêler le rôle de la récidive qui est intimement associée dans bien des cas, comme dans nos trois observations (Obs. 13, 11 et 0)

Il est vraisemblable que les deux éléments: *péri-urétérite* (prise dans son sens le plus général) et *nécrose de l'uretère,* s'associent toujours plus ou moins.

Mais dans les sténoses isolées, la péri-urétérite est prédominante et la nécrose absente ou modérée.

Dans les fistules au contraire, les deux sont associées avec prédominance nette de la nécrose.

CONCLUSIONS PROPHYLACTIQUES

Notre conclusion sur la prophylaxis sera brève.

Devant un mal aussi grave que le cancer du col, nous continuons d'associer le radium et la chirurgie, malgré leur action nécrosante commune sur les uretères.

Nous n'avons pas de procédé qui *puisse protéger l'uretére contre les radiations* tout en laissant le tissu qui l'entoure exposé à la destruction.

Les précautions techniques que nous avons citées ne permettent pas d'éviter *l'ischémie opératoire* dans la zone critique paramétriale.

Bien entendu nous ne parlons pas des *précautions destinées à éviter la blessure opératoire de l'uretère:* celles là sont essentielles et doivent être appliquées systématiquement, mais là n'est pas le problème. . . .

Ce n'est pas non plus le *délai entre le temps physiothérapique et le temps chirurgical* qui peut avoir une grande importance pathogénique.

Mais deux possibilités d'amélioration nous semblent ouvertes cependant:

1°) Une *amélioration du drainage pelvien supprimant le lympho-hématome infecté,* qui à notre avis joue un rôle important dans la péri-urétérite, et une *antibiothérapie élective* et portée in situ dans le foyer opératoire sus vaginal.

2°) *La prophylaxie de l'infection urétérale* de la pyélo-urétérite, dont nous avons montré l'action néfaste d'où:

a) *Surveillance du transit urinaire,* comme le conseille Dargent. Nous préconisons une urographie systématique le 5° jour à la période du début des complications possibles et une le 20° jour avant la sortie de la malade.

b) *Surveillance aussi de l'infection urinaire* par des analyses répétées et *mise en oeuvre précoce du traitement médical.*

Mais l'antibiothérapie même élective (après antibiogramme) ne suffit pas: Il faut lutter d'emblée contre la rétention par la *mise à demeure précoce* d'une sonde urétérale.

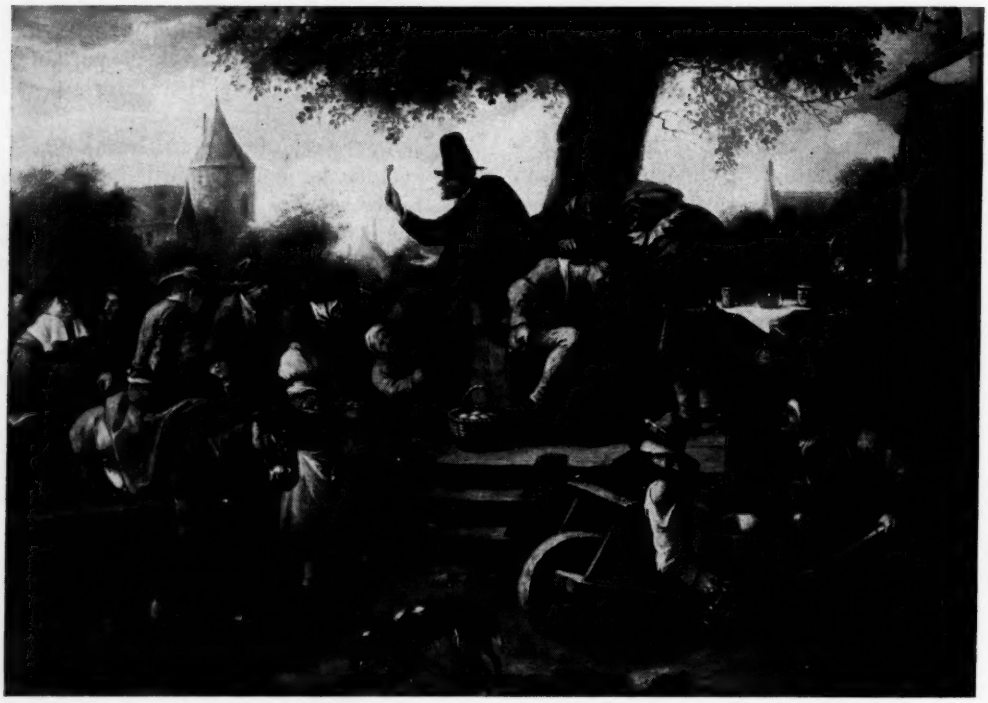
C'est au prix de ces quelques précautions supplémentaires que nous espérons arriver à diminuer à l'avenir le pourcentage encore lourd de ces complications que nous jugeons jusqu'ici "inévitables."

RÉSUMÉ

Notre propos n'est pas de nous étendre sur le *traitement curatif* des complications sérieuses "fistules et sténoses" de l'uretère.

Soulignons cependant la valeur de l'excellent procédé de Boari, qui permet de se tenir à distance du foyer d'infection et de sclérose et de réaliser aisément une plastie urétérale à l'aide d'un lambeau vésical.

Il a procuré la guérison dans les trois cas où nous l'avons appliqué, et nous en recommandons l'emploi précoce dès que la lésion est constituée, sans attendre la distension et l'infection rénales invétérées.



The Tooth-Drawer, by Jan Steen. The tooth-drawer is gleefully holding aloft the enormous molar he has extracted from the jaw of the bound, howling patient. He has gathered the crowd of villagers around him by playing the violin hanging in the right-hand corner. The patients have brought eggs and produce in payment of his fees. The sufferer in the foreground has evidently been imbibing in an effort to summon up courage for the ordeal. (*Reproduced by courtesy of the Rijksmuseum, Amsterdam, The Netherlands.*)

—Hamilton Bailey, F.R.C.S. (Eng.), F.A.C.S., F.R.S. (Edin.), F.I.C.S. (Hon.)

Seccion en Español

Terapéutica Quirúrgica de la Retinosis Gravídica

(Surgical Treatment of Severe Retinosis)

CARLOS MALABEHAR PENA, M.D.*

MEXICO D. F., MEXICO

Mentioning the direct and indirect relations that may exist between disease of the eye and other pathologic conditions, which may be referable to infection, glandular conditions, cardiovascular disease, conditions affecting the respiratory or the genitourinary system, metabolism, etc., the author proceeds to discuss severe retinosis, its treatment by surgical intervention and the results that can be expected.

A PASO y medida que la Medicina General ha ido progresando, las especialidades médicas, y en el caso particular, la Oftalmología, ha tomando más interés para el clínico general y el cirujano, pues cada vez existe más íntima relación entre accidentes generales de distintas disciplinas, y las manifestaciones locales, o focales en el ojo de muy diversos padecimientos.

De sobra conocidas son las relaciones existentes entre la Oftalmología y las enfermedades infecciosas, las del sistema circulatorio, las de la sangre, las del aparato respiratorio y urinario, los padecimientos de las glándulas endócrinas, las enfermedades metabólicas (diabetes, gota, obesidad, etc.,), los síntomas carenciales de avitaminosis, las afecciones del aparato locomotor (reumatismo, etc.), los padecimientos del sistema nervioso, (especialmente tabes y tumores cerebrales), la pediatria, las alergias, las afecciones dermatológicas, las otorinolaringológicas, las psicosomáticas (glaucoma), y en último término, pues vamos a referirnos a una de ellas, las ginecopátias.

En trabajo anterior del suscrito, hicimos referencia a las "Complicaciones Oculares del Embarazo," procurando una relación ordenada y suscinto de los distintos accidentes, que durante este acto fisiológico, y transitorio del organismo femenino, se presentan a través del embarazo y del puerperio.

En el trabajo mencionado, procuramos poner en cierto orden útil, las complicaciones oculares del embarazo, mencionando los edemas, blefaritis, alteraciones cutáneas, accidentes conjuntivales, accidentes subjetivos, avitaminosis, trastornos glandulares, in toxicaciones (especialmente por tabaco y alcohol) y al final nos referíamos a toxemias por nefritis, en sus distintas manifestaciones, para terminar con algunas consideraciones sobre toxemia gravídica.

*Professor de Clinica Oftalmologica en la Facultad de Medicina; Director y Jefe del Servicio Oftalmologico del Hospital Concepcion Beistegui.

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Es por ésta complicación del embarazo, que debiera establecerse, para prevenirla, o por lo menos para hacer un diagnóstico precoz, que a no dudarlo se obtiene siempre por el examen oftalmoscópico, antes de las manifestaciones ostensibles del estado general, la tendencia del examen sistemático del fondo del ojo desde el primer trimestre del embarazo, como una medida de rutina en toda mujer en gestación, aunque ésta siga un curso normal, pues se obtendría, para los ginecoobtetras, a travé del examen periódico del oftalmólogo, una información totalmente útil para el tratamiento oportuno de la toxemia gravídica.

Aclaremos, antes de hacer consideraciones sobre esta última, y de sus lesiones oculares, que una cosa es la toxemia gravídica y otra las manifestaciones durante el embarazo, de nefritis pre-existentes, que revisten a veces gravedad suma, por cuanto que la función renal ya está afectada antes de la gravidéz, y que cuando de ésta circunstancia se trata, el pronóstico para la vida, siempre es fatal a un plazo de uno a tres años.

En las nefrofatías puras, existen comunmente, tarde o temprano lesiones oculares, caracterizadas, grosso modo, por edema palpebral bilateral, aumento del tono ocular, reducción del campo visual, escotomas, reducción de la agudeza visual, a veces hasta la pérdida absoluta de ésta, y lesiones de fondo de ojo bilaterales, consistentes en edema papilar, espasmos circulatorios, y aparición de pequeñas manchas blanquecinas, en forma de copos de algodón, que constituyen la retinosis albuminúrica.

Estos fenómenos coexisten con elevada tensión arterial, albúmina variable en la orina, retención ureica, cambios metabólicos en los iones sodio y potasio y accidentes de insuficiencia renal, no reversibles (al contrario de la toxemia gravídica) y que aunque no conducen a la ceguera total o definitiva, mas que en el caso de desprendimiento grande de la retina, agravan el pronóstico, y lo hacen sombrío en cuanto a la vida misma de la paciente.

La toxemia gravídica propiamente dicha, y sus manifestaciones conocidas con los nombres de pre-eclampsia y eclampsia, que no son sino distintos grados de la misma enfermedad, es de etiología aun dudosa si nó desconocida; pero la creencia más aceptada es que está ligada a la existencia de factores téxicos, probablemente de origen placentario, y a alteraciones circulatorias del músculo uterino.

Clínicamente, es fácil reconocerla, pero muchas veces, cuando los accidentes se han presentado en forma fulminante.

Ocurre generalmente entre el tercero y noveno mes de la gestación. El mayor número de casos se observan del sexto al noveno mes, cuando el feto ya es viable.

Es más frecuente en las primíparas, aunque puede presentarse en multíparas sin antecedentes previos, y aún en todos los embarazos de una misma mujer.

Podría afirmarse que la pre-eclampsia es una forma larvada de la eclampsia misma. Sin presentar la agravación considerable de las manifestaciones clínicas de la eclampsia pura, como la disritmia cerebral, las convulsiones y el estado comatoso.

En todos los casos la manifestación precoz más ostensible es la hipertensión arterial, *la seventidad de la cual da el alerta para vigilar desde un principio las manifestaciones retinianas.*

El cuadro pre-eclámptico se caracteriza por moderada hipertensión, ligero edema y, escasa albuminuria (de 0.10 a 0.80 por litro) y puede ser compatible con la terminación normal del embarazo, como una forma frustra de la eclampsia.

La eclampsia pura, presenta síntomas cerebrales, visuales, gastro-intestinales, y renales, de pronóstico grave.

Cuando la cifra tensional sigue aumentando, la cantidad de albúmina subiendo (puede llegar hasta 10 y 12 gramos por litro) el edema persiste o aumenta, existe

cefalea, vértigo, somnolencia, taquicardia, poliuria, e hipertemia, náuseas, vómito, oliguria o anuria, y accidentes oftalmoscópicos, caracterizados al principio por vasoespasmos, y poco después por manifestaciones retinianas, que pueden ser anteriores a los accidentes generales graves. Este cuadro puede semejarse, para el diagnóstico diferencial, con la glomérulo-nefritis difusa aguda que presenta síntomas cerebrales y convulsivantes.

El espasmo circulatorio (espasmos arteriolares), la peri-papilitis, el edema papilar, y la aparición de esclerosis de los vasos, seguida de focos hemorrágicos, exudados (poco frecuentes) y el edema de la retina, antes de la invasión de la mácula lútea (lesión irreparable de ceguera), y la aparición de "copos de algodón," conducen la terapéutica del caso, más que el estado general de la enferma.

En estas condiciones, la colaboración estrecha del Oftalmólogo y del obstetra es indispensable.

Abrigamos la creencia, que muy a pesar del tratamiento general llevado inteligentemente, no obstante los recursos terapeúticos actuales, como el reposo en cama, la sedación delsistema nervioso central, la medicación hipotensora, la diuresis provocada para evitar la retención del sodio y agua, y eliminar los edemas (diamox) el uso del suero glucosado, del sulfato de magnesia, el largactyl (en experimentación), y el moderno empleo de la novocaína intravenosa, etc. el tratamiento de elección para salvar a la madre y en un nivel bajo al producto de la concepción, es la interrupción quirúrgica del embarazo, especialmente por haber enfatizado antes, que la eclampsia pura, se presenta cuando el feto es viable.

En estadística de Rochon-Duvignaud, presentada a la Sociedad Francesa de Oftalmología, sobre accidentes oculares provocados por eclampsia manifiesta:

Muertes en embarazos a término	15%
Muertes en embarazos interrumpidos artificialmente	4%
Ceguera en embarazos a término	25%
Ceguera en embarazos interrumpidos	6%
Muerte del producto de la embarazada con afección gravídica ocular	80%

en 55 casos observados.

Este cuadro indicaría, que el mejor pronóstico para la vida de la madre, sería dado por la interrupción precoz del embarazo, a la luz de la severidad de los datos oftalmológicos obtenidos.

En lo personal, difiero grandemente de la estadística mencionada, por lo menos en nuestro medio.

En 34 años de ejercicio profesional contínuo, he tomado parte activa como consutante en cerca de 200 casos de eclampsia gravídica en todas sus fases, y cuando ésta ha sido de forma pura (es decir, sin enfermedad renal previa), no he encontrado secuelas posteriores al parto o a término, *que produzcan ceguera definitiva* y, en cambio, en las enfermas observadas, muerte del producto en un grado más alto hasta 90%.

Existen casos de relativa frecuencia en la práctica privada, en las que por ignorancia, por apatía, por no consultar regularmente al médico, o por consideraciones de índole moral, en las que la enferma o los familiares deciden que el caso se resuelva espontáneamente, en los cuales se interviene fuera de tiempo y pueden provocar la pérdida de dos vidas: madre e hijo.

Citaré a este respecto un caso en el cual colaboré con el extinto Maestro D. Gonzalo Castañeda, quien fuera Primer Presidente Nacional del Capítulo Mexicano del Colegio Internacional de Cirujanos, de una enferma, en el séptimo mes de la gestación, con feto muerto ocho días antes, con gran hipertensión y albuminuria altas, que se rehusaba a ser operada, por considerar que

su hijo podía nacer normalmente y consideraba un delito el parto provocado.

Con la muerte del producto, los fenómenos de la toxemia gravídica se modifcaron grandemente, especialmente los signos oftalmoscópicos, lo que demuestra la reversibilidad o labilidad del síndrome.

Al fin fué operada, pude seguir observando a la paciente, la cual conservó después del puerperio, presión arterial elevada, albuminuria de 10/1000, reducción del campo y agudeza visuales, y murió dos años después por síndrome de hipertensión.

Insistiendo en que la toxemia gravídica tiene mayor incidencia del sexto al noveno mes, cuando la viabilidad del feto puede significar la vida del producto y, dado que aún en las mejores condiciones, el tratamiento médico fracasa. En un porcentaje elevado de enfermas, *debe procederse sistemáticamente a la desocupación quirùrgica del útero gravídico.*

Proceder el cirujano al estudio del momento propicio; si el cuello está maduro, practicar la ruptura de las membranas, y preferentemente, procurar actuar cuando las crisis convulsivas han sido controladas por medios terapéuticos, actuando entonces por inducción del parto, por versión, por maniobras internas, si el *cervix* está maduro, o en caso contrario practicando una cesárea abdominal.

Cuando la intervención ha sido oportuna y llevada con rapidez, el producto puede sobrevivir en un promedio de 10 a 20%, pero los fenómenos tóxicos, se hacen reversibles, la recuperación de la madre se hace rápidamente, los accidentes oculares desaparecen sin dejar huella, y por lo menos, se ha logrado salvar una de las dos vidas amenzadas.

No creemos que deba adoptarse a posteriori, la conducta de proceder a la ligadura de las trompas, pues en la misma persona, puede efectuarse después un embarazo normal, a pesar del antecedente del anterior con toxemia gravídica.

BIBLIOGRAFIA

Fuchs, y Salzmann, F.: Tratado de Oftalmolgía.

Duke-Elder, S.: Text Book of Ophthalmology.

Beekman, F.: Treatment in General Practice (3/a. Edición).

Argañaras, F.: Manual de Oftalmología.

Maggiore, O.: Manual de Oftalmología.

Amsler, M., y Franceschetti, A.: Oftalmologia (Salvat 1954).

Romer, P.: Oftalmología (3/a. Edición).

Laffite, E.: Tratado de Patología Interna.

Recasens, S.: Tratado de Obstetricia.

De Lee, J.: Tratado de Obstetricia.

Malabehar Peña, C.: Complicaciones Oculares del Embarazo. Trabajo de Ingreso a la Academia Nacional de Ciencias de México, 1948.

Enciclopedia Medico Quirúrgica: Oftalmología. Velter-Renard.

De Laet, H., y Hubinont, P. O.: Hipertensión Arterial Retiniana en la Eclampsia. XXVI Congreso Internacional de Oftalmologia. Londres 1950.

Hallum, A. V.: Modificación en las Artenolas retinianas asociadas a la hipertensión del embarazo. Archivos de Oftalmología 4:37, 1947.

Alndesman, R., Douglas, R. G., y Snyder, S. S.: Alteraciones del fondo del ojo en las toxemas gravídicas. Am. J. Obst. & Gynec. 62:5, 1951.

Leiter, L.: Observaciones Oculares en las Toxemias Gravídicas. Am. J. Ophth. 33:4, 1950.

Magee, A. J.: Las Comprobaciones Oculares durante la Toxemia Gravídica, Am. J. Obst. &. Gynec. 62:3, 1951.

Simposia: Organo de la Sociedad Médica del Hospital Francés de México, Franco-Mexicana, vol. 1, No. 3, Dic. 1956. "Gestosis," Dr. Castelazo Ayala.

Seccâo em Portuguéz

Corpos Extranhos do Aparelho Genito-Urinario de Criancas do Sexo Feminino

(Foreign Bodies in the Female Genitourinary Tract)

W. PINHEIRO, M.D., F.I.C.S.

SAO PAULO, BRAZIL

Three cases are reported of foreign bodies in the female genitourinary tract. All three patients were children, aged respectively 3, 9 and 11 years, the 9-year-old child being Japanese but a resident of South America. The investigation and treatment in each case are described.

ENQUANTO que ocorre com relativa frequência a incidência de córpos extranhos nas cavidades naturais de crianças, nariz e ouvidos, são bastante raros os casos registrados na literatura especialisada e referentes ao aparelho genito-urinário. Não obstante, consequimos reunir em nossa clínica particular, tres casos, ultimamente, aparecidos e que para aquí trazemos mais como contribuição estatistica que pelo valôr científico que possam despertar. Vamos narra-los, resumidamente e sem comentarios, tal como os presenciamos.

1)—J. V. S., menina de apenas três anos de idade, de grande vivacidade e bastante dócil, filha de abastados fazendeiros, veio ao nosso serviço em companhia da progenitôra que nos narrou o seguinte: desde há já quatro mezes notou que a menor, até então muito saudavel, vinha apresentando manchas amareladas em suas peças intimas, estado que rapidamente se agravou a ponto de torna-la mal cheirósa ao menor descuido higienico. Ouvido um pediátra e seguida a medicação por ele instituida, por cerca de quarenta dias, verificou que a filhinha, pouco ou nada havia melhorado, razão por que veio á nossa procura.

Por se tratar de criança bastante dócil foi-nos facil examina-la convenientemente; colocada na mesa ginecologica constatamos desde logo uma intensa vulvovaginite, estando os genitais externos congestos e cobertos de secreção amarelada, viscósa e de odôr desagradavel. Afastados os grandes lábios o himen se apresentou reduzido a uma simples orla, sem sinais de violência, o que dava amplo acesso á cavidade vaginal do que nos aproveitamos para a colheita de material para exame microscópico que, de resto, nada revelou de mais importante; germes banais abundantes, ausência de bacilos acidofilos assim como de protozoarios, celulas de descamação. Pareceu-nos á vista da constatação feita, tratar-se de um caso de vulvovaginite banal pelo que instituimos um tratamento a base de pomadas de antibioticos de largo espectro, topicamente, tônicos vitaminicos

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Fig. 1 *(Caso 1, J. V. S.)*.—Tampinha de materia plastica retirada da vagina da menor.

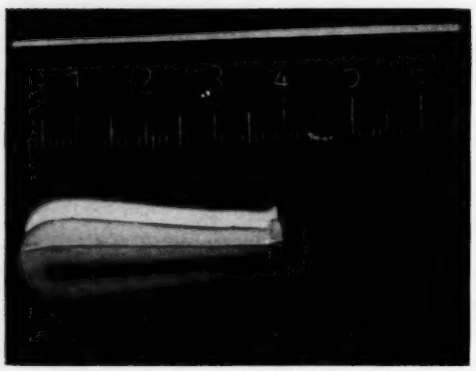

Fig. 2 *(Caso 2, K. S.)*.—Borrachinha de pingagotes retirado da vagina da menor.

e estrógenos em dóses fraccionadas. Inicialmente, os resultados foram animedores, entretanto, já na segunda semana de tratamento, aos poucos o corrimente crecia de volume assim que os curativos eram espaçados.

Variamos a medicação tópica, percorrendo toda a gama dos ditos "especificos" e nada de mais positivo obtivemos quando, já um tanto desanimados, ante a rebeldia do caso, ouvimos da mãe da menor, que tambem se impacientava, o seguinte: Doutor, certa vez, parece-me, filhinha disse-me ter posto uma tampinha, ao que não dei maior importância nem mesmo pensando em tal possibilidade.

Alertados por essa informação, ainda que vaga, resolvemos fazer uma sondagem vaginal utilisando-nos de um estilete metalico de extremidade olivar, com ele procurando executar um movimento circular em torno do cólo uterino. Logo ao atingirmos o fundo de saco posterior sentimos o contacto de quelquer cousa que atritava contra o estilete; repetimos a manobra e já agora não tivemos mais dúvidas de que, realmente, lá estava um corpo extranho. Com uma pinça dente de rato, fina e angulada, conseguimos, depois de uma tentativa frustrada, agarrar o intruso e traze-lo para fóra da vagina e aquí documentado com a foto no. 1: tampinha de materia plastica. A menor restabeleceude, prontamente, podendo-se mesmo dizer que a doença deixou de existir, desde a remoção do côrpo extranho.

2)—K. S., 9 anos, filha de japonêses e residente na Fazenda Nova América, veio á consulta em companhia de uma irmã casada que, sem maiores preambulos contou-nos a seguinte história: ontem á tarde, K. S. que se achava com outras crianças procurou-me, muito assustada, dizendo que estando a brincar com uma borrachinha de pinga-gotas, sem saber como, desaparecera em seu corpo, indicando-lhe o logar escolhido para a brincadeira de mau gosto . . . Pósta a menor na mesa ginecologica e afastados os grandes lábios, através da ampla fenda himenal, não dilacerada, entretanto, conseguimos localisar o côrpo extranho e com facilidade extrai-lo, do qual aquí exibimos a foto de no. 2.

3)—D. C., 11 anos de idade, filha de pequenos agricultores, orfã de mãe, vivendo em companhia da madrasta com quem veio á consulta. Tratava-se de uma menina bastante robusta, precocemente desenvolvida, inteligente e extremamente maliciósa e desde o inicio do interrogatorio percebemos que nenhuma informação util, dela obteriamos. Mesmo ápos a inesperada revelação feita pelos R. X. a sua ati-

tude não se modificou e dirse-ia estar ela adredemente instruida para afastar de si todo e qualquer sentimento de culpa no sucedido.

Sua história, assim se resume: tendo sempre gozado de excelente saude, começou, entretanto, desde há tres mezes queixar-se de perturbações urinarias, com micções frequentes e dolorosas sendo por isso obrigada a levantar-se muitas vezes durante a noite, para urinar o que fazia com grande sofrimento.

De inicio, não deram os familiares maior importância ao caso, procurando resolve-lo com remedios caseiros o que, evidentemente, não lhe trouxe melhóras. Procurou, então, um facultativo que lhe prescreveu, sulfas e penicilina de que fez uso seguido, por cerca de 1 mez o que lhe deu a certeza de cura compléta. Por essa época, fazendo uma viagem de caminhão, num percurso de 50 kilometros, nada de anormal sentiu durante o passeio; mas, na noite desse mesmo dia, acordou sentindose mal e, quando, com grandes esforços, consegiu emitir um pouco de urina, constatou, com espanto, que ela era vermelha como sangue. Alarmada a familia, providenciou a vida imediata de um medico que, em face da hematuria constatada aplicou-lhe logo uma injeção de coagulêno, prescrevendo-lhe a seguir vitamina k, per os e repouso no leito, medidas estas que surtiram pronto efeito. Uma semana após, sentindo-se bem dispósta, resolveram os familiares regressar á casa, fazendo-o dessa vez em automovel como medida de precaução. Não obstante esse cuidado, assim que chegou, as dores reapareceram e ao urinar notou que o sangue, novamente, se fazia presente. Retomou, então, a medicação anteriormente prescrita durante alguns dias e ao sentir-se melhor veio á consulta. Ouvida a sua historia, começamos o exame pelo interrogatorio que, como acima ficou dito, foi, absolutamente inutil, de vez que, tanto ela como a madrasta

Fig. 3 *(Caso 3, D. C.)*.—Foto *(A)* e roentgenograma *(B)* da bacia e calculo extraido da menor.

pouco mais nos adeantavam alêm da época em que a moléstia apareceu, já que os esclarecimentos acima foramnos prestados pelo pái.

Palpação e toque retal, nada revelaram de importante; o exame ginecologico, comprovou a virgindade da paciente.

O exame de urina evidenciou um processo de cistite cronica, com o cortejo de todos os elementos sempre presentes em tais circunstâncias. Entretanto, não nos contentamos com esse resultado já que a coincidência da hematúria com as viagens feitas, sugeria-nos algo de mais importante. Providenciamos, então, o exame cistoscópico que, não obstante a cistite existente, foi muito bem tolerado, mostrandose a bexiga com bôa capacidade de enchimento o que oferecia bôas condições tecnicas para a exploração vesical.

Feita ligeira inspeção da bexiga, orien-

tamos o cistoscopio para a zona do trigono, onde fomos encontrar um grande calculo de superfice granulósa, cor amerelada e aparentemente redondo, já que as suas extremidades laterais estavam recobertas pela mucósa vesical e a ela aderentes como ficou demonstrado no ato cirurgico. Para complementar a cistóscopia, pedimos uma radiografia que nos tóuxe a surprendente revelação qual fosse a presença de um grampo de cabelos como o nucleo, em tôrno do qual o calculo se formára.

Propuzemos, então, a intervenção por via alta já que, condições peculiares ao caso, grampo metalico, potencialmente contundente, de um lado e virgindade de outro afastavam a possibilidade de outras vias de acésso. Aceita a propósta, no dia imediato praticamos uma cistotomia supra-pubica que não apresentou maiores dificuldades, alêm dos descolamento do calculo, intimamente aderido á mucosa vesical, pelas suas extremidades laterais. Terminamos a intervenção por uma dupla drenagem, suprapubica e uretral, com sondas adequadas.

As sequências operatórias foram as mais favoraveis possivel, suprimindo os drenos, resepivamente, nos 5° e 11° dias, deixando a paciente o Hospital, no 13° dia em perfeitas condições. A peça extraida ora constituida por um calculo fosfatico que pesou, no momento da extração, nada menos de 10 gramas e aqui é apresentado por meio da foto de no. 4.

O roentegenograma aquí exibido, tomado do baixo ventre da menor, foi-nos fornecido pelo radiologista Dr. R. Savastano a quem agradecemos, assim como ao Dr. Vilas-Bôas, auxiliar da intervenção, pela colaboração prestada.

Agóra, cabe aquí uma indagação: como e quando teria o grampo, causa diréta de toda essa complicação, ido parar na bexiga da menor D. C. ?. O como foi e será sempre um segredo que ela, desde o inicio, procurou, maliciosamente, guardar para si mesma. Já o quando, parece-nos mais facil de vez que seja apenas uma questão de calculo, dessa vez, matematico.

Comprovaram os estudiósos do assunto que os calculos dessa natureza crescem numa média de 2 gramas por ano, portanto, pesando o especime em apreço cerca de 10 gramas, pelo menos, de quatro a cinco anos foi esse grampo, hospede pouco incomodo de uma bexiga complacente.

With Hippocrates' death the practice of examining patients and taking careful histories died out. Galen, a celebrated physician about six hundred years later, recorded histories of his patients, but his histories were evidently intended mainly for publication, as they are largely descriptions of his great skill in curing disease.

—*Major*

Editorial

The Surgeon in the Invisible World: Microbiology and Immunology

MORRIS C. LEIKIND, M.Sc.*

WASHINGTON, D.C.

IN the history of surgery, the chapter dealing with the rise of bacteriology and immunology is one of the most fascinating and dramatic. I hope to make this evident in the pages to come.

If we examine the structure of modern surgery, we may say that it rests upon four principal foundation pillars. The first of these is the pillar of anatomy, and one of its chief builders was Andreas Vesalius, who published his great work *De Fabrica*, etc., on the structure of the human body, in 1543. The second pillar is that of physiology, erected by William Harvey in 1628 when he published his little book announcing his discovery of the circulation of the blood. The third pillar is anesthesiology, a much newer one that was unveiled to the world only in 1846, when W. T. G. Morton, a dentist, publicly demonstrated the anesthetic properties of ether at the Massachusetts General Hospital in Boston. The fourth pillar, the subject of this essay, is microbiology and immunology.

All will surely agree that without an accurate knowledge of anatomy, normal and pathologic, surgery as we know it today would be impossible. And it is equally obvious that knowledge of the functions of the various parts of the body, that is, physiology, is also a *sine qua non* to the well-equipped surgeon. Yet, until slightly more than a century ago, even the most knowledgeable surgeons had to contend with one of the most terrible impediments to the successful practice of the craft—pain. In an address before the Medical and Chirurgical Faculty of the State of Maryland in April 1899, William W. Keen, one of the great American surgeons of the nineteenth century, said: "Prior to that time (i.e., 1846) a surgical operation was attended with horrors which those who live in these days cannot appreciate. He was the best surgeon who could perform any operation in the least possible time. The whole object of new methods of operating was to shorten the period of frightful agony which every patient had to endure. Every second of suffering saved was an incalculable boon. . . . All of the more modern, deliberate, careful, painstaking operations involving minute dissection, amid nerves and blood vessels, when life or death depends on the accuracy of almost every touch of the knife, was absolutely impossible. It was beyond human endurance quietly to submit one's self for an hour, for an hour and a half, for two

*Formerly Medical Historian and Archivist, Armed Forces Institute of Pathology.

From the National Institute of Pathology.

hours or even longer, to such physical agony."

For the relief of such suffering, anesthesia was indeed a blessing and a gift from heaven. Nevertheless, even after the conquest of pain, the surgeon was still hampered in the successful performance of his tasks by the dread specter of infection.

The control of infection is now so routine a part of the surgeon's training and indeed so ritualized in its performance that he can be adjudged guilty of malpractice if he fails to take any necessary step to prevent infection. Yet, until almost a century ago, infection and death from infection were regarded as unavoidably frequent concomitants of surgical practice.

In 1826, John Bell, Professor of Surgery in Edinburgh, one of the outstanding surgeons of his day, published a new edition of his work, *Principles and Practice of Surgery*. In his chapter on abdominal surgery (p. 313) he wrote, "Having put it down as prognostic, which is but too well confirmed by much melancholy experience, that wounds of the belly are mortal, there is no reason why we should, in recording new cases take note of a man having died after such a wound. Death from such a wound is a daily and expected occurrence, and therefore is not marked; but if we find that a man has escaped, are we not to record each such escape?" Today we see the situation almost exactly reversed. Now it is a comparatively rare patient who fails to recover from abdominal injury or surgical treatment, and then his case becomes the subject of special study. And in such cases, the cause, more often than not, is some factor other than infection. With regard to other regions of the body, Bell wrote with equal hopelessness. Wounds of the joints were regarded as mortal, and his picture of the wards of a hospital is not pleasant to contemplate: "You look upon limbs variously wounded, but all of them lying out, swollen, suppurating, fistulous, rotting in their own filth, having carious bones, bleeding arteries and a profusion of matter; the patients exhausted in the meanwhile, with diarrhea, fever and pain."

Erysipelas, tetanus, pyemia and septicemia—these were the constant bedside companions of every patient who entered a hospital in those days. During the Crimean war it was said that one could always know when he was in the vicinity of a hospital, "owing to the stench of human putridity it contained."

Hospital gangrene, a disease whose bacteriologic background is not known today, was endemic in most hospitals. Bell, after graphically describing this infection, cries out in anguish:

> "What then is the surgeon to do? Is he to try experiments with ointments and plasters while men are dying around him? Is he to seek for washes and dressings to cure such a disease as this? Is he to expend butts of wine contending as it were against the elements? No! Let him bear this always in mind, that no dressings have ever been found to stop this ulcer, that no quantities of wine or bark which a man can bear have ever retarded this gangrene; let him bear in mind that this is a hospital disease, that without the circle of the infected walls men are safe; let him therefore hurry them out of this house of death; let him change the wards, let him take possession of some empty house and so carry his patients into good air; let him lay in a schoolroom, a church, on a dunghill or in a stable; let him carry them anywhere but to their graves."

I could continue "ad nauseam" with quotations and statistics showing under what horrible conditions surgery was practiced in earlier days. Indeed, by the middle of the nineteenth century, surgery seemed to have reached an impasse. Of brilliant and courageous surgeons there was no dearth. But what did it avail surgeons to

operate successfully when they lost so many patients afterwards to infectious disease?

It was at this time that a revolution occurred in surgery—a revolution so far-reaching in its consequences that it completely transformed the art of the surgeon. This revolution is generally attributed to the emergence of the germ theory of disease and its application in a system of antiseptic surgery, later to be modified to aseptic surgery.

In most popular accounts of the history of surgery, two men are usually mentioned above all others as responsible for this beneficent revolution: Louis Pasteur and Joseph Lister, the first a chemist, the other a surgeon. In this presentation, however, it is not my intention to repeat a story already well known. What I wish to do is to discuss, from a much broader viewpoint, the rise of microbiology and immunology and to show how in the course of this development surgery itself was altered; how surgery, which seemed to have reached a dead end of futility, was in fact rejuvenated and was able to advance to new heights of achievement in the relief of human suffering and the extension of human life and usefulness.

Microbiology or, more specifically, bacteriology, is a relatively new science. Most of us, even if we should have to undergo major operations in the meantime, will be able—thanks to the contributions of bacteriology—to witness and perhaps even participate in the celebration of the tricentennial anniversary of the discovery of bacteria in 1976, only eighteen years from now. For it was in 1676 that a Dutchman named Antony van Leeuwenhoek first saw bacteria and protozoa (little animals, he called them) and thus became the first microbiologist.

This discovery raised no sputnik furor in Leeuwenhoek's time or world. Scarcely anyone knew of his discovery and almost no one was aware of its significance. It is doubtful whether Leeuwenhoek himself foresaw the consequences. Let us see for a moment who this man was and what he did.

Antony van Leeuwenhoek was born in Delft, Holland, on Oct. 24, 1632, and he died there ninety-one years later, on Aug. 26, 1723. The son of a basket maker and a brewer's daughter, he was apprenticed at the age of 16 to a linen draper in Amsterdam. Here he probably became acquainted with magnifying glasses used to examine the threads in cloth. His life until about 1670 seems to be obscure, although it is known that he married, re-

During the forthcoming months of 1959 and as long thereafter as possible, the editorial pages of the Journal of the International College of Surgeons *will be honored by presentations of rare and extraordinary historic value, the lectures presented at the International Surgeons' Hall of Fame on medical and surgical history from the earliest recorded achievements to those of our own times. We believe that* Journal *readers who were not able to attend the lectures will find them as exciting as did the audiences present at their delivery. The story of progress in the healing arts and the giants of medicine and surgery to whom we owe the amazing brilliance and scope of modern achievement is intrinsically thrilling and is a vital part of the education of every cultivated man and woman, inside or outside the profession. It is altogether fitting that it should appear in these pages, since the International College of Surgeons is first, last and always a teaching institution.*

turned to Delft, opened his own shop and in addition became Chamberlain of the Town Hall and also official wine-gauger of the city of Delft. Then suddenly, in 1673, Leeuwenhoek became known as an amateur scientist, having published a paper in the Philosophical Transactions of the Royal Society of London. It seems that after his apprenticeship in the linen shop he had acquired an interest in magnifying glasses and the curiosities revealed by them.

At this point I must digress for a moment to emphasize the fact that, contrary to popular belief, Leeuwenhoek did not invent the microscope. The truth is that the inventor of this instrument is not known with certainty. Like the telescope, it seems to have been simultaneously devised in Holland and Italy near the end of the sixteenth and the opening of the seventeenth century. Although optical instruments were unknown in antiquity, optics had advanced sufficiently in the Middle Ages so that spectacles were invented about 1300 in Italy. These were undoubtedly the ancestors of magnifying glasses and simple lenses, known and used before the first compound microscope was made. The persons generally credited with the invention of a compound microscope are Hans and Zacharias Jansen, father and son, lens grinders of Middleburg, Holland. They are believed to have made such an instrument—and indeed it still exists—at some time between 1590 and 1608. There is no evidence that the Jansens ever used their instrument for serious scientific investigation. At about the same time, however, Galilei Galileo in Italy, learning of this optical device by letter, proceeded independently to make a microscope of his own. More significantly, he introduced it to the scientific community. So, as Singer has so aptly said, we may regard Galileo as the effective inventor of the microscope.

It is evident, therefore, that microscopes, simple and compound, were already in existence when Leeuwenhoek took up microscopy as a hobby. And a very serious hobbyist he became. Not satisfied with such lenses as he could buy, he learned the art of lens grinding. He even made his own lens holders of wood, brass, bone and some of gold and silver. He quickly found that compound microscopes were difficult to use and that it was almost impossible to get good illumination. Worst of all, chromatic aberration made observing a very frustrating experience. Consequently he devoted himself exclusively to making and using simple lenses.

Possessed of an insatiable curiosity, a superb technic in the making of lenses and in the manipulation of objects under study, and last but least, a genius for observation, Leeuwenhoek turned his glasses on an almost incredible number of subjects, mineral, animal and vegetable. In the realm of biology he discovered so many things that almost every branch of this science might claim him as its founder. He saw and described red blood cells and spermatozoa; differentiated striated from smooth muscle and confirmed Malpighi's observations on the capillaries, thus providing the final proof for Harvey's theory of the circulation, to mention just a few of the discoveries of this remarkable man.

For us, however, his most significant achievement was his discovery of microbes in 1676. In that year, on October 9 to be exact, he wrote a letter to Henry Oldenburg, Secretary of the Royal Society of London. In this letter—the eighteenth in a series of two hundred sent to the Society — Leeuwenhoek described a variety of minute forms of life never before seen by the eyes of men. From his descriptions we know that he saw vorticella, ciliates and a number of protozoa. In addition he saw bacteria. His account of his discovery is both instructive and amusing. He did not set out to discover microbes. His real object was to find out what makes pepper

hot. Like a good scientist, he had formed an hypothesis and then designed an experiment to test it. His hypothesis was that pepper was made up of tiny round grains whose surface was covered with sharp spines. These spines irritated the tongue and thus gave rise to a sensation of heat. He reasoned that these little spiny granules were enclosed in larger peppercorns. Therefore, if these large peppercorns were soaked in water, they would become soft and release the spiny granules, which could then be observed under the microscope. Thus the experiment was set up. Some days later, Leeuwenhoek examined a drop of this pepper water to see how things were progressing. One look through his lens and he forgot all about the pepper experiment. As he wrote later: "I saw therein with great wonder unbelievably many very small animalcules of various sorts . . ." He described three different forms and then continued ". . . the fourth sort of animalcules which floated about amongst the other three sorts, were incredibly small; indeed so small in my sight, that I judged if all of 100 of these very small animalcules were stretched out against one another, they would not reach the length of a coarse sand grain. This being true, then ten hundred thousand of these living creatures should not be able to fill the volume of a coarse sand grain."

Careful study of Leeuwenhoek's writings leaves no doubt that he actually did see bacteria. Nevertheless, there is no valid evidence that either Leeuwenhoek or his contemporaries grasped the significance of this observation. No one realized that these "little animals" were connected in any way with such natural processes as fermentation and putrefaction. No one suspected that microbes were concerned with brewing and baking, with the making of wine and the production of cheese. And least of all did anyone dream that the solution to the mystery of infection,

Fig. 1.—Jacob Henle. (*Reproduced by courtesy of the National Library of Medicine.*)

of plagues and epidemics, lay in a drop of pepper water under a tiny lens. The mystery of course was ultimately solved. It was solved, as we all know, during the last portion of the nineteenth century.

Definite and scientifically acceptable proof that bacteria cause certain diseases was given to the world in 1876, exactly two hundred years after microbes were discovered. This fact raises a very interesting question. Why did it take two hundred years to discover the connection between bacteria and disease? Two centuries is a long time.

Many reasons have been advanced to explain the lag between the discovery of microbes and the application of this knowledge to the problems of disease. Poor optical equipment was of course an important deterrent to progress in a field where the microscope plays such an important role. However, from 1830 on, notable improvements in the microscope and in

microscopy began, slowly, it is true, to remove some of the obstacles to progress.

An even more important reason was the persistence of erroneous ideas about the nature of diseases and their causes.

From his very beginnings man has been a creature looking for the causes of happenings. He knew, for example, that a limb falling from a tree could cause a broken head—that a stone thrown by an enemy could cause a wound of fatal consequences. He knew that wild animals could bring about injuries and even death, and he learned that certain plants, if eaten, were detrimental to health and a menace to life itself. All of these dangers he recognized and he even made attempts to prevent these causes from operating or, when possible, to repair the damage resulting therefrom. Surgery thus arose from man's attempts to cope with injuries brought about by recognizable external agencies.

But the problem of disease and death arising from causes or agencies not evident to the senses posed an altogether different problem to our ancestors. Arrows could be dodged—but who could dodge a pestilence? One could fall asleep a well man and awake sick and miserable. The skin could discolor, the head ache, the eyes and nose discharge, chills and fever rack the body, cramps knife through the abdomen, strength to take food or to hold it could be lacking. Often death resulted—sometimes not. Yet no one knew why. No cause was visible or evident to any sense organ. Frequently, not individual persons but whole communities and often nations were afflicted with epidemic disease without ascertainable cause.

No wonder that early man, as some primitive peoples still do today, attribute disease to malevolent spirits, angry deities, vindictive enemies capable of sorcery, or the offended spirits of the dead. A logical product of these early notions of the causes of disease was the medicine man or witch doctor. His therapy was based on the theory that since disease was caused by evil or malign spirits who must be exorcised, or angry or displeased gods who must be appeased, vigorous methods were necessary. Hence the spectacular therapeutic procedures in which the doctor dressed in terrifying costumes and made a great noise with shouts, rattles and drums, all designed to frighten the demons out of the patient's body. Charms and amulets to ward off the return of the demons were also used, while special offerings and ceremonies were thought to help appease the anger or displeasure of a god. The theurgical theory of disease was common not only among primitive peoples but even among those whose social and economic order was much more advanced—Egyptians, Babylonians, Hebrews, Greeks and also the Romans.

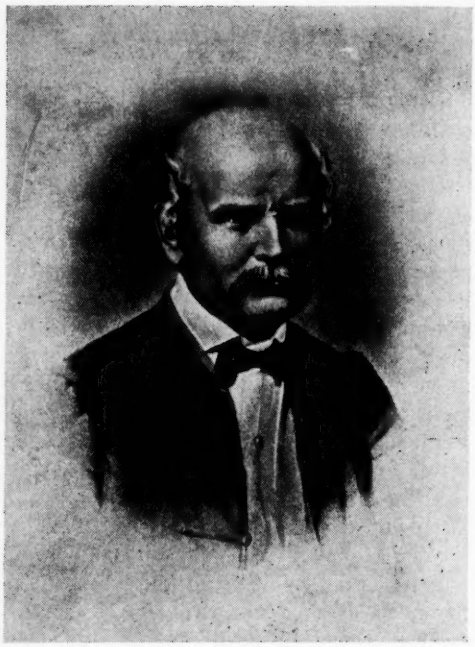

Fig. 2.—Ignaz Philipp Semmelweiss. (*Reproduced by courtesy of the National Library of Medicine.*)

With the passage of time and as peoples

became more sophisticated, diseases, especially infectious ones were attributed to cosmotelluric causes, i.e., eclipses, comets, earthquakes, abnormal rains or droughts, and especially changes in the atmosphere resulting from pollution by noxious vapors or emanations from swamps. Such emanations were known as miasmas and the miasmatic theory of disease held sway for a very long time. The word malaria—literally "bad air"—is a verbal fossil recalling such beliefs.

Over the centuries, however, a few acute observers and advanced thinkers began to speculate on the possibility that minute forms of life, such as worms or insects or perhaps even some invisible animate body, might in some way be concerned with the causation and transmission of infectious diseases. One of the earliest to give explicit expression to such an idea was Hieronymous Fracastorious (1478-1553), an Italian physician who was also a poet and astronomer. His treatise *Contagion, Contagious Diseases and Their Treatment* is a landmark in the history of our knowledge of infectious diseases. The author classed such diseases into three types: (1) diseases transmitted by immediate contact (true contagions); (2) diseases transmitted through intermediate agents like fomites—he defines fomites as follows: "I call fomites—clothes, wooden things and other things which are not corrupted but are able to preserve the original germs of the contagion and to give rise to its transference to others"—and (3) diseases infecting at a distance or through the air, such as pestilential fevers, phthisis and conjunctivitis. In presenting these ideas Fracastorius showed himself to be an original thinker, and he did crystallize the diffuse and amorphous thought of his day. Although he spoke of germs as seminaria, he did not possess a microscope and presented no experimental proofs of his theory. Nevertheless, his book did influence epidemiologic thought for a long time. About a century later, in 1658, Athanasius Kircher (1602-1680), a Jesuit priest with a taste for scientific investigation who did possess a microscope, came somewhat closer to the truth. He claimed to have seen minute worms in the blood of plague patients and wrote that these were the cause of the disease. Kircher's instrument, we now know, was not powerful enough to enable him to have seen bacteria, and it is probable that he saw clumps or rouleaux of red blood cells, forms that could be mistaken for worms.

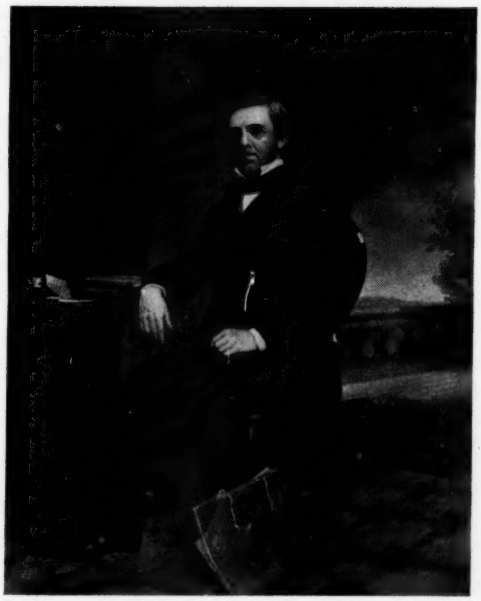

Fig. 3.—Oliver Wendell Holmes. (*Reproduced by courtesy of the National Library of Medicine.*)

It is evident, then, that by the time Leeuwenhoek discovered bacteria a few persons were already beginning to speculate about minute animate agents of infectious disease. After Leeuwenhoek's discovery even more persons began to publish their speculations. Thus, during the eighteenth century Benjamin Marten (1704-1782), and Richard Bradley (?-1732), both Englishmen, M. A. von Plenciz

(1705-1786), an Austrian, and J. B. Goiffon (1658-1730), a Frenchman, all independently propounded germ theories of disease. None of these writers, however, came forward with any experimental proof or even with concrete suggestions for experiments to test their guesses. Despite the fact that, collectively, their ideas came somewhat close to the truth, their contemporaries were not convinced.

The basic difficulty was that, between the time of Leeuwenhoek and Robert Koch, *no one knew how to handle bacteria.* From the time of Leeuwenhoek on, everyone who attempted to study bacteria and other forms of microscopic life used free-living forms, i.e., those that could be found in a drop of pond water or in some decaying, putrefying or fermenting matter. No one knew whether these organisms were plant or animal. In 1735, when C. Linnaeus (1707-1778) published his great classification of living things, he placed bacteria in class *Chaos,* a good place for them, since this category reflected the thinking of the time about these organisms. Even C. G. Ehrenberg (1795-1876) and O. F. Müller (1730-1784), who were among the first to make systematic studies of microbes, did so on forms they found in nature. The idea of cultivating germs, of obtaining them in pure culture and of studying their physiologic and biochemical as well as their morphologic nature was a notion that did not appear until after the middle of the nineteenth century. As a matter of fact, as long as men were content to study free-living forms there was even room for a theory of spontaneous generation. Since no one knew where microbes came from, it was quite logical to believe that they were the *result* of fermentation or putrefaction rather than the cause. Justus von Liebig (1803-1873), the great German chemist, did believe just that.

Equally logical was the notion that germs were the result of an infectious process rather than the cause. Nevertheless, the great controversy over spontaneous generation was actually a step in the direction of learning to handle bacteria, since the experiments performed by John T. Needham (1713-1781), Lazzaro Spallanzani (1729-1799), Theodor Schwann (1810-1882), Franz Schulze (1815-1873) and Theodor von Dusch (1824-1890), to mention but a few of the workers, developed some of the technics that made possible the manipulation of microbes.

Side by side with the speculations about spontaneous generation, nevertheless, individual workers were accumulating evidence that pointed to an association of microbes with disease. Thus in 1834, Agostino Bassi (1773-1856), an Italian who had been studying a destructive disease of silkworms (called *muscardine* by the French and *mal de segno* by the Italians) published the results of his investigations. He showed that the disease was contagious and was caused by a parasitic fungus. Furthermore, he suggested that such contagious diseases as smallpox, typhus, plague, cholera and syphilis were caused by living parasites. Bassi's work on *muscardine* was confirmed in 1835, and observations along similar lines were made in France and Germany; but these remained isolated instances, unsupported by hard proofs and not unified by any comprehensive theory.

In 1840 the first breakthrough in the problem appeared. Jacob Henle (1809-1885) in that year published a little book entitled *Pathologische Untersuchungen.* The opening chapters on "miasmata and contagia" are justly regarded as classics in the literature of bacteriology. Here we find for the first time a coherent theory that living microorganisms caused infectious diseases. Reasoning from facts collected by many workers, Henle attempted to create some order out of the confused welter of ideas concerning the nature and

causes of contagious and infectious diseases.

Henle was not the first, as we have seen, to voice a microbic theory of disease, but he was the first to suggest a *modus operandi* for proving the truth of such a theory. He pointed out that only by experiment could it finally be determined whether or not microbes cause disease. He argued that morbid matter in patients with infectious diseases seems to increase from the moment it enters the body, and from this Henle concluded that the morbid principle must be organic and therefore living. The incubation period that commonly precedes the outbreak of a disease also suggested that a living organism was multiplying in the body of the host. Henle recalled the observations of Bassi and others and reasoned that such an organism was probably a form of plant life. Additional support for this reasoning came from the work of C. Caignard-Latour (1777-1859) and T. Schwann (1810-1882), who had already found evidence that fermentation resulted from the action of minute organisms — yeasts. And now Henle proceeded to lay down the postulates of proof that would have to be met in order to show conclusively that specific organisms were the causes of specific diseases. The conditions were that a specific organism must always be found associated with a specific disease—that it should be possible to isolate the organism from mixtures and grow it outside the body—and, finally, that after isolation this same organism should be capable of inducing the same disease in an experimental animal. Henle himself performed none of these experiments. Twenty-five years later, however, his brilliant pupil Robert Koch (1843-1910) did succeed in producing evidence which satisfied his master's canons. Indeed, every student of bacteriology, and of medicine as well, knows them as Koch's postulates.

Before discussing the work of Koch, however, it is necessary to consider for a few moments a contemporary whose contributions were equally notable — Louis Pasteur. So much has been written about him that it would be superfluous to attempt to add anything new. Nevertheless, there are a few points about his work which I wish to recall. As is well known, Pasteur (1822-1895) was neither a physician nor a biologist. He was a chemist, and he became involved in the study of infectious diseases through a rather devious set of circumstances. His work demonstrates beautifully how the disinterested search for apparently useless knowledge can produce results of the highest practical importance.

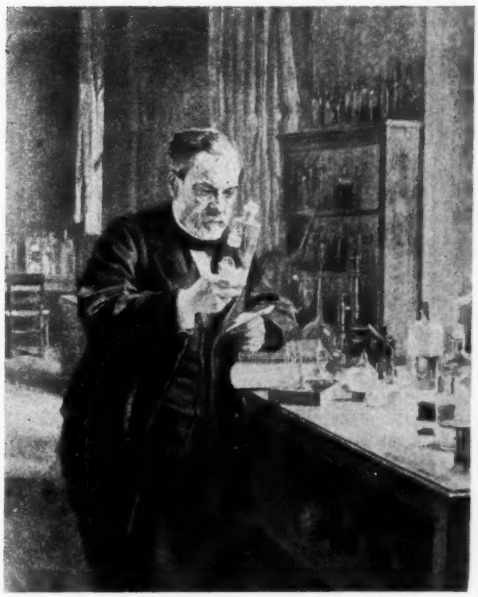

Fig. 4.—Louis Pasteur. (*Reproduced by courtesy of the National Library of Medicine.*)

Pasteur chose, as the subject of his first serious scientific investigation, tartaric acid. It seemed that there were several forms of this acid which, though chemically indistinguishable, varied in the way its solutions rotated the plane of a beam of polarized light. His first step was to

study the crystals of tartaric acid and also those of a variant form known as racemic acid. He soon observed, with the aid of a microscope, that some of the crystals had one corner missing. And then he noted that this irregularity was not haphazard. In some crystals a right-hand corner was absent, in others a left-hand one was missing. In fact, the crystals were mirror images of each other. Pasteur already suspected that crystal form and chemical structure were related and that optical activity as observed with polarized light might be an indicator. To test his hypothesis, he made up some batches of crystals and then proceeded to separate them into two groups of right-handed and left-handed forms. When he dissolved the crystals and placed the solutions into a polariscope he found that the right-handed crystals rotated the beam of light to the right and the others to the left. And then, finally, he found that if he mixed equal numbers of the crystals and dissolved them, the resulting solution was neutral to polarized light. This solved the mystery of racemic acid, which turned out to be nothing but a mixture of two optically different forms of tartaric acid.

From these studies Pasteur moved on to a study of a whole family of organic acids, and he soon found something else of interest. He observed that certain organic acids were associated with fermentation and furthermore that they displayed optical activity associated with the presence of certain ferments. By that time (1857) Pasteur was Dean of the Faculty at Lille, the center of the great distilling fermentation industries of France. He studied in rapid succession various kinds of fermentation, alcoholic, acetic, lactic, butyric, malic and others. In each case he was able to show that the reaction was dependent upon the presence of specific living ferments. He showed that with each type of fermentation a certain type of organism was always present. He was able to isolate the organism and to grow it in pure culture in an artificial culture medium he devised, and with these organisms he could initiate specific fermentations at will. These experiments, of course, provided exactly the sort of evidence Henle had called for to prove that specific organisms were the causes of specific diseases. It is therefore easy to understand now how Pasteur, a chemist, was able to approach the problems of infectious diseases.

It will not be out of place here to recall that about two hundred years earlier (area 1650) Robert Boyle (1627-1691), one of the founders of modern chemistry, had declared that "he that thoroughly understands the nature of ferments and fermentations shall probably be much better able than he that ignores them, to give a fair account of divers phenomena of several diseases (as well fevers as others) which will perhaps be never properly understood without an insight into the doctrine of fermentations." Prophetic words indeed.

In the course of his studies on the nature of fermentation, Pasteur was called upon to advise the brewers and distillers of his locality about the causes of the spoilage of beer and the souring of wine. Because of his earlier studies he was able quickly to show that, here again, specific fermentations were the result of specific microbial activity and that when the fermentation went awry it was because of the invasion of foreign organisms that produced products other than the desired alcohol. Pasteur thus conceived the idea of diseases of beer and wine and showed how these could be prevented by suppressing the activities of all organisms except the specific ones that produced the desired reaction of fermentation. He showed that by simply heating wine at a specified temperature for a short time it was possible to kill off the undesirable ferments. This process, now universally applied to milk

as well as to alcoholic liquors, is the familiar method known as "pasteurization."

A logical bypath of these investigations was the problem of spontaneous generation. I have already mentioned that many persons, including Liebig, had argued that fermentation and putrefaction were not caused by the activity of living organisms but, rather, that the organisms were generated by the fermentative or putrefactive process. Pasteur had to answer these arguments. If his contention was true, that specific organisms were the cause of specific fermentations, he would have to demonstrate that if these organisms were excluded no fermentation would take place.

With characteristic vigor, Pasteur entered on the now historic controversy over spontaneous generation. Partly by virtue of his experimental skill and partly by luck, he was able to show that the spontaneous generation of microscopically visible organisms was a fiction. He showed that bacteria and related organisms are universally distributed through the atmosphere; that, being particulate, they are subject to the laws of gravity and settle out from quiet air, that this air, free from dust, cannot initiate fermentation in fermentable fluids, and finally that these microbes, if one follows the technic of Schroeder and von Dusch, can be filtered out from the air by cotton wool. Thus, air which has been drawn through a cotton wool filter cannot initiate fermentation, but if a susceptible fluid is allowed to touch contaminated wool, fermentation promptly begins. Pasteur was not alone in these studies. In England, John Tyndall (1820-1893) was conducting similar experiments, and his results served to bolster those of Pasteur, indicating that spontaneous generation could not be demonstrated if appropriate technics and precautions were used.

And now a most significant practical application of some of Pasteur's results was made to the field of surgery—an application that became evident quite early, even though all the important questions about the relation of microbes to infection had not been answered.

Surgery, as we have already seen, had by the middle of the nineteenth century reached an impasse. Pain, one of the great factors limiting the advance of surgery, was coming under control through anesthesia, but sepsis still stalked hospital wards and operating theaters. Rare indeed was the surgeon who could boast of a low mortality rate among his patients. Henle's writings had inspired no surgeon to look into the causes of surgical infection. The tragic Ignaz Semmelweiss (1815-1865) of Hungary had shown (he had no knowledge of microbes) that the simple precaution of hand-washing by surgeons, doctors and midwives could reduce the incidence of puerpural fever to the vanishing point. The American writer and physician, Oliver Wendell Holmes (1809-1894), had almost simultaneously with and independently of Semmelweiss also concluded that childbed fever was contagious and preventable. The time was not yet ripe, however, for the next major advance in surgery. It was Joseph Lister (1827-1912), an English surgeon, who made this possible.

Lister was not only a surgeon, he was an investigator as well. Early in his professional career he became interested in the phenomenon of inflammation. He was struck by the fact that patients with simple fractures suffered less from inflammation at the site of injury than did those with compound fractures, were practically free of infection and of pus and generally made rapid and uncomplicated recoveries. In those with compound fractures, the picture was different. Infection was almost inevitable, and the rate of mortality was very high. Lister suspected that something carried by the air entered the wound in a case of compound fracture

and induced infection, with all its sequelae. In 1865 he learned of the work of Louis Pasteur and glimpsed at once the implications for surgery.

He reasoned that if wound infections were caused by germs floating in the air that came into contact with injured tissue, then such infections could be prevented by destroying the germs. He began to search for a suitable chemical or antiseptic substance. He hit upon carbolic acid* and began to develop his system of antiseptic surgery. His first patients were treated in August 1865, and he began to publish his results in 1867. In his own hands his method produced remarkable results, but his principles were slow in gaining acceptance. And the reasons for the lack of enthusiasm among medical men for Lister's antiseptic surgery were essentially the same as during the time of Semmelweiss and Holmes. Even in 1867 there was no really convincing proof that bacteria could cause disease, and the reason was, as I have mentioned earlier, that methods for handling microbes were still in their infancy.

Pasteur, it is true, was already on the road to the demonstration—still awaited—that a specific organism was in fact the cause of a specific disease. But he was a chemist, and no medical man, except Joseph Lister, paid any attention to Pasteur's work. And even Lister's work was empirical in the sense that he made no effort to isolate and identify specific organisms as the causes of specific types of wound infection. True, he did work with the lactic acid bacillus, but this was mainly for the purpose of developing technics useful in practicing antisepsis.

The fact is that thinking about bacteria was still greatly confused. At one time or another various observers had claimed to have seen or even demonstrated that one type of organism could be converted into another. The great Viennese surgeon Theodor Billroth (1829-1894) argued that there was only one organism capable of infinite variation. Obviously such thinking could not make for clarity in this matter. It is now evident that what was required was a reliable technic for isolating bacteria, identifying them and maintaining them in pure cultures in order to study their morphologic and physiologic nature. Pasteur, as we have seen, had already made a beginning at studying microbial physiology, but his attempts at pure cultures were vitiated by his reliance on liquid culture media.

The first to make some really substantial contributions to the solution of this problem was Ferdinand Cohn (1828-1898) of Breslau. A botanist, he had long been interested in bacteria. In 1852 he firmly established the fact that these organisms were members of the plant kingdom. His next step was to attempt to classify these forms, and he quickly realized that morphologic data were alone inadequate as a basis of classification. In attempting to separate bacteria into species, he became aware of the fact that organisms that were morphologically similar could be physiologically different. Pasteur had already shown this to be true with respect to fermentation reactions. The minute size of bacteria, of course, made them extremely difficult to work with, and there were many who believed that pure cultures of microbes were impossible of attainment. In 1872, however, a significant lead came from Ferdinand Cohn's laboratory. He had long been fascinated by the chromogenic bacteria. These organisms, which can often be found on solid materials undergoing decay, produce beautiful pigments. Cohn set his student J. Schroeter (1835-1894) the task of studying this pigment production. He grew his organisms on solid surfaces, such as slices of potato and hard-boiled eggs, or on meat, for it was on such media that the pig-

*Lister was apparently unaware that J. Lemaire, a French pharmaceutical chemist, had advocated the use of carbolic acid as an antiseptic as early as 1860.

ments were produced.

The use of such solid media was not in itself a brand-new development, since mycologists had long been using gelatine for growing fungi. Schroeter was one of the first, however, to use solid media for the systematic study of bacteria. He found that specific organisms produced specific pigments. On a slice of potato, for example, he might find three colored dots, one red, one yellow and one purple. Each dot was a colony of bacteria. A fragment of the dot placed under the microscope revealed that all the members of the colony were morphologically similar. Now if a bit of the red colony were transferred with a needle to a fresh slice of potato and allowed to grow, only red colonies appeared; the results were similar with purple and yellow colonies. The secret of pure culture technics had been found, but neither Cohn nor his pupil apparently realized the far-reaching implications. The application of this technic to problems of medical microbiology, however, was not long in coming.

In 1876 Cohn played host in his laboratory to a young and unknown doctor who claimed to have proved, experimentally, that anthrax, a disease of sheep and cattle, was caused by a specific germ. The disease was of considerable economic importance, and many workers had attempted to discover its cause. As early as 1849 F. Pollender (1800-1879), a German veterinarian, and later C. Davaine (1812-1882), a French pathologist, had described rods in the blood of animals dying of anthrax. They failed to recognize their significance. The work of Pasteur then led to a reexamination of the problem, and it began to be suspected that these rods might, after all, have something to do with the disease. Davaine, in a long series of inoculation experiments, showed that the rods were invariably associated with the disease. If he injected blood containing no rods into a healthy animal, no symptoms of anthrax

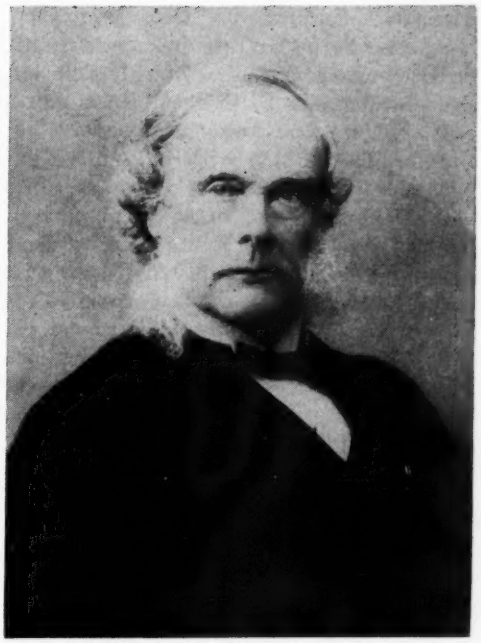

Fig. 5.—Joseph Lister. (*Reproduced by courtesy of the National Library of Medicine.*)

appeared; but as long as the rods were present, as controlled by microscopic observation, Davaine was able to induce the disease, using almost fantastically small quantities of blood. Nevertheless, the proof was not considered absolute. There were objectors who argued that the rods were merely the carriers of a potent virus or poison. Davaine had no method of proving whether this was so or not. And there the problem remained until Robert Koch (1843-1910) appeared on the scene. A country medical practitioner, he was a self-taught research worker. In medical school he had studied under Henle and apparently had become interested in experimental pathology. Between patients he found time to set up a small laboratory in his home. For a problem he chose anthrax, a disease that was very prevalent on the farms in his neighborhood. Koch was a born experimenter and very ingenious at devising laboratory methods. He

began his studies with mice as experimental animals. When inoculated with blood from sick cows they quickly sickened and died, and in their blood Koch found rods similar to those described by Davaine. But he did not stop with inoculation experiments. He sought for a way to cultivate the organisms outside the animal body. He wanted to get the bacteria out in pure culture and then grow them in a series long enough to dilute out any possible poison or virus of which a rod might be a carrier. Only then could he be sure that the rod was indeed the cause of anthrax. His first method was to grow the organisms in hanging drop preparations, which he could observe under the microscope. In the course of these studies he observed the spore stage of the bacillus, a stage which Cohn himself had predicted but had not seen. When organisms grown by Koch outside the animal body were then injected into susceptible animals, they came down with anthrax. Koch had proved unequivocally the postulates of proof demanded by Henle his teacher.

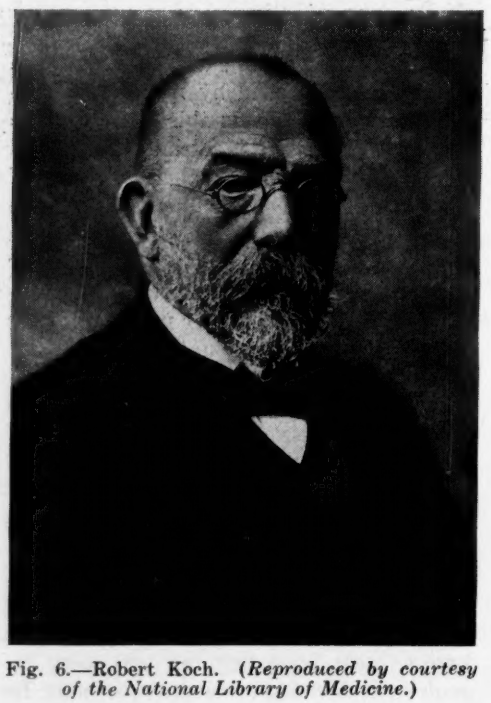

Fig. 6.—Robert Koch. (*Reproduced by courtesy of the National Library of Medicine.*)

Koch now devoted himself to the development of technical methods for the handling of bacteria, for he realized that therein lay the secret of success in establishing bacteriology as a science. His most important contribution in this direction was in generalizing and standardizing technics for pure culture. It has often been said that he stumbled on the solid culture technic by observing colonies of bacteria on a slice of potato that happened to be near an open window in his laboratory. That may be so, but we also remember that Koch had spent a few days in Ferdinand Cohn's Institute in Breslau while making his anthrax demonstrations, and he must have seen Schroeter's work on the pigmented bacteria. At any rate, Koch recognized the fact that further progress in bacteriology was dependent on the development of a solid nutrient medium that could easily be sterilized. On such a medium, mixtures of bacteria, when sufficiently diluted and dispersed, would grow as discrete colonies, each presumably the offspring of a single organism. By successive transfers to fresh sterile culture plates, each colony could be purified and then maintained for detailed study. Early in the 1880's Koch's pupil Walther Hesse, at the suggestion of his American-born wife, introduced agar-agar as a solidifying agent instead of the gelatin that Koch first used. Gelatin had certain undesirable properties, and agar-agar proved so superior that it became the standard culture medium throughout the world.

In addition, a number of other technics were developed to facilitate the handling of bacteria. Improved microscopes were of the utmost importance, of course, for obviously one had to see clearly the material one was trying to handle and identify. One of the most important aids to visibility under the microscope was the

introduction of stains and staining technics. The devolpment of staining methods provides another beautiful example of how knowledge acquired in one field of science makes possible advances in other fields, wholly undreamed of by the original discoverer.

The first aniline dyes were discovered in 1856. Within a few years they were found useful in staining tissues for microscopic examination. In 1875, Carl Weigart (1845-1904) showed that bacteria could be stained with aniline dyes, thus enabling the investigator to recognize them in tissues. Robert Koch simplified the technics, and further advances were made by Paul Ehrlich (1854-1915).

With the aid of these powerful new technics, the science of bacteriology developed with amazing rapidity. In quick succession, the causative organisms of some of the most devastating and widespread diseases were isolated and identified. In 1882 Koch discovered the tubercle bacillus and Loeffler and Schutz isolated the bacillus of glanders; in 1884, Klebs and Loeffler independently found the causative organism of diphtheria and Gaffky isolated the typhoid bacillus (it had been seen in tissues by Eberth in 1880), and in 1885 Escherich cultured bacillus coli. In 1886 Fraenkel obtained pure cultures of the pneumococcus, and in the following year Bruce discovered the cause of Malta fever, or undulant fever, as the disease is now called. In 1894 the causative agents of plague and of botulism were discovered, and in 1898 one of the types of dysentery bacilli was identified. These are just a few examples of the host of discoveries that followed, once the technics of handling bacteria were mastered, and thus we see why it took two hundred years for practical consequences of Leeuwehoek's discovery of microbes to appear. And we can also see how the development of manipulative technics for handling bacteria freed the hands of the surgeon by giving him the power to eliminate infectious agents that invaded his own field of manipulative activity.

Now, finally, I must say a few words about the second half of my title, the period that witnessed the rise of immunology. The twin sciences microbiology and immunology actually gave the surgeon two strings for his bow in fighting infection. Antiseptic surgery, later modified to aseptic surgery, made possible the control of infection, mainly by denying external infective agents access to the body. Immunology, among other things, made it possible for the surgeon to utilize effectively the natural forces of the body for resisting and overcoming infection.

The idea of immunity or resistance to disease and to noxious agents is very ancient. From remote antiquity men have sought for a universal antidote either to protect against the effects of a poison

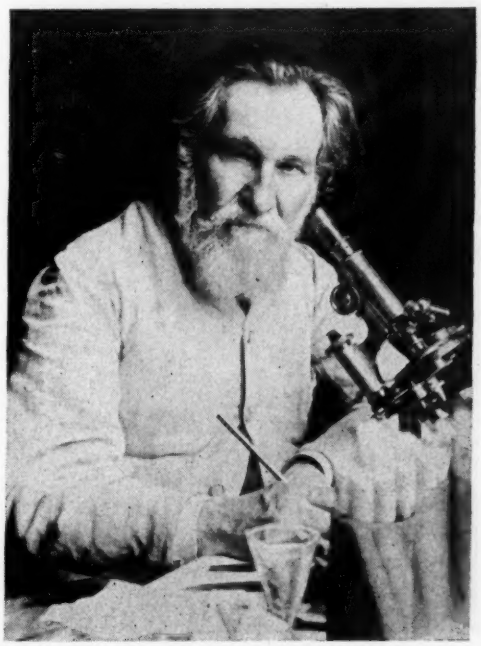

Fig. 7.—Elie Metchnikoff. (*Reproduced by courtesy of the National Library of Medicine.*)

or to counteract one already administered. One recalls the legendary King of Pontus, Mithridates, who lived around the first century B.C. and was in constant fear of assassination by poison. He studied the effects of poisons on the bodies of slaves and criminals and tried to find an antidote. In one of his experiments he is said to have fed ducks with increasing amounts of poisonous substances, beginning with very small doses. When the birds were able to tolerate very large amounts of poison without ill effects, he killed them and drank their blood hoping in this way to transfer their resistance to poison himself. Today the phenomenon of acquired tolerance to certain poisons is known in our pharmacology texts as mithridatism.

The next step in the slow development of a science of immunity came almost at the end of the eighteenth century, when

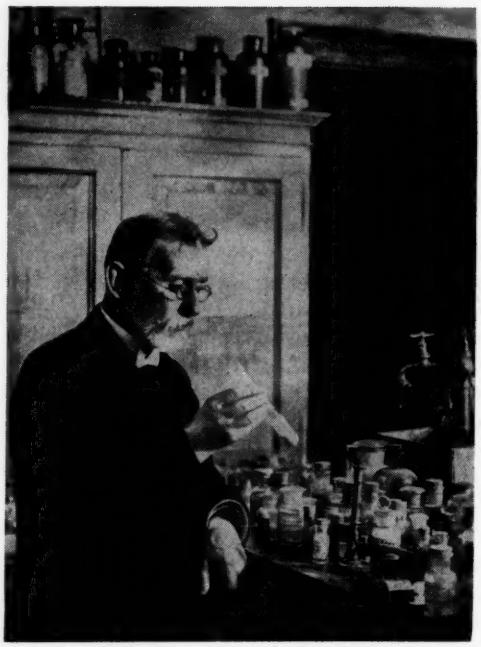

Fig. 9.—Paul Ehrlich. *(Reproduced by courtesy of the National Library of Medicine.)*

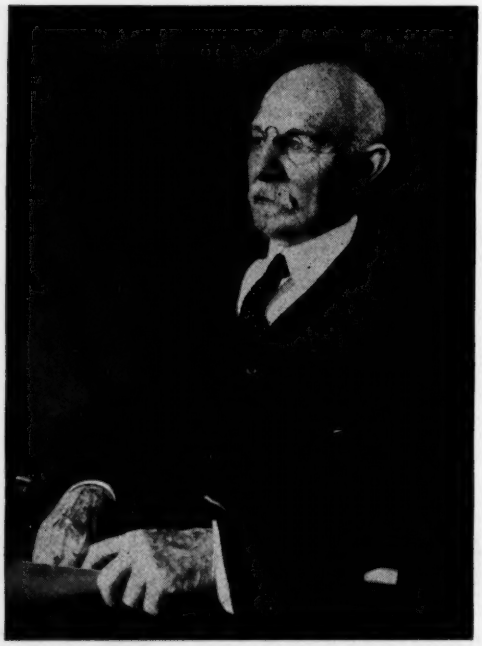

Fig. 8.—William S. Halsted. *(Reproduced by courtesy of the National Library of Medicine.)*

Edward Jenner (1749-1823) introduced vaccination against smallpox. An earlier method of protection against this disease, known as variolation or inoculation, had been practiced in various parts of the world for many centuries. Jenner's method superseded it, proving to be safer and more reliable in its results. Nevertheless, this was an isolated instance of a purely empirical immunization procedure. The cause of smallpox was as yet unknown; the germ theory of disease was still to be established, and there was no theory to explain the mechanism of preventive inoculation against smallpox.

We have already seen how the work of Pasteur, Lister, Cohn, Koch and a host of others had already established the basic principles of the science of bacteriology and the fact that some forms of microbial life are the causative agents of many contagious and infectious diseases. Joseph

Lister, the surgeon, made practical application of this new knowledge by devising his system of antiseptic surgery; but, while Listerism was essentially preventive, in denying infectious organisms access to places where the infective process could take place, it did not solve the entire problem of infectious disease. To arrive at methods of controlling infectious disease, the mechanism of the infective process had to be discovered and understood.

As is so common in scientific research, accident played a role in opening up this field of investigation. In 1880 Pasteur discovered by chance that an old culture of fowl cholera organisms, which he was studying, would not induce disease in chickens. Furthermore, he noted that birds inoculated with such old cultures displayed no symptoms of disease when cultures of chicken cholera organisms of known virulence were injected. His genius grasped the significance of this observation. He saw at once that this was a phenomenon similar to Jennerian vaccination, and he quickly generalized the idea into a theory of immunity. In a similar way, Pasteur found that he could confer protection against anthrax in animals by inoculating them with anthrax bacilli, the virulence of which had been reduced by growing the organisms at an elevated temperature. His greatest triumph came when he succeeded in developing a method of protective inoculation against rabies.

In 1886, D. E. Salmon (1850-1914) and Theobald Smith (1859-1934) of the U. S. Department of Agriculture made a most significant contribution. They showed that killed cultures of certain bacteria could also induce immunity in the animal body against live virulent organisms in doses fatal to unprotected control animals. The way was thereby opened to the large-scale development of protective vaccines against such diseases as cholera, typhoid and plague.

Emil Roux (1853-1933) and Alexander Yersin (1863-1943), working in Pasteur's laboratory, in the meantime were studying the diphtheria bacillus. In 1888 they announced that this organism produced a soluble toxin in fluid cultures. This toxin could be separated from the bacteria by filtration and would produce symptoms of the disease in suitable experimental animals. In 1890 Emil Behring (1854-1917) and S. Kitasato (1852-1931), working in Berlin, demonstrated a toxin produced by the tetanus bacillus. Almost immediately these same investigators found that when such toxins were injected into animals in sublethal doses, neutralizing antibodies or antitoxins were, after a certain period, detectable in the blood. This was a discovery of major importance, since it made possible the control of two diseases important to the surgeon, diphtheria and tetanus. Tetanus, once the dread of the military surgeon, is no longer a problem.

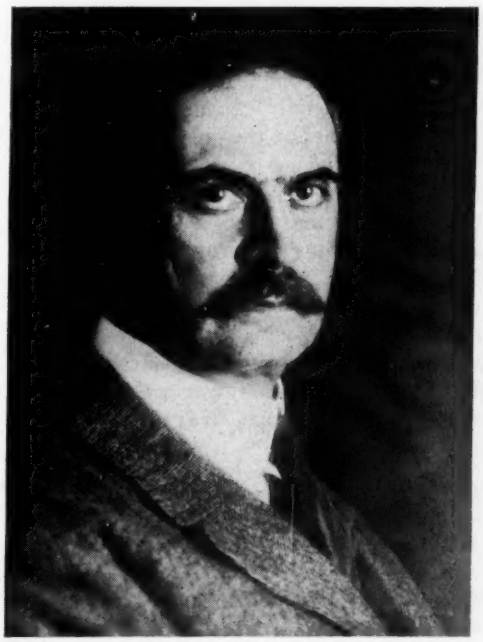

Fig. 10.—Karl Landsteiner. (*Reproduced by courtesy of the National Library of Medicine.*)

Alongside of these discoveries came the announcement in 1883 of the theory of phagocytosis by Elie Metchnikoff (1845-1916), another of Pasteur's associates. He showed experimentally that the white corpuscles in the blood play a significant role in ridding the body of invading bacteria and similar foreign bodies. This same idea had, as a matter of fact, been voiced earlier (1881) by George Miller Sternberg (1835-1915), then a Surgeon in the United States Army, later its Surgeon General. The discovery of the function of the white blood cells in defending the body against microbes gave the surgeon yet another weapon in his war against infection.

Finally, another discovery stemming from early work in the new science of immunology was the recognition of the blood groups in 1900 by Karl Landsteiner in Vienna. Safe blood transfusions were now possible, and the number of lives saved by this procedure in the past half century or so is almost beyond calculation.

Space does not permit a discussion of the role of chemotherapy and the antibiotics in the conquest of the "invisible world." I can only recall to the reader's mind that, during the years often called the "Golden Age of Bacteriology," the aniline dyes, which through their staining properties made microbes visible, were now, by the genius of Paul Ehrlich (1854-1915), turned into potent weapons for the destruction of germs. The creation in the chemical laboratory of a whole new family of drugs and antiseptics aided the surgeon immeasurably in his war against infection. Early in World War II and in the years immediately following came the fantastic development of the antibiotics, one of the first of which—penicillin—had been described by Sir Alexander Fleming (1881-1955) in 1929.

In summary, we have seen how surgery —a manipulative art—has advanced in four major movements, like a sailor climbing a rope. First, the surgeon, following the example of Vesalius, learned to know anatomy by studying it with his hands. Second, from William Harvey he learned physiology, again by studying with his hands (experimentally) how the parts of the body work. Third, anesthesia gave him control of pain, so that his hands could more safely and easily perform his operations. Fourth, from Pasteur, Cohn, Koch, Lister, Halsted and many others, he learned how to handle infectious agents and either keep them out of the body or destroy them after they got in.

BIBLIOGRAPHY

Bulloch, W.: The History of Bacteriology. New York, Oxford University Press, 1938. Pp. 422.

Cheyne, W. W.: Antiseptic Surgery: Its Principles, Practice, History and Results. London: Smith-Elder, 1882. Pp. 616.

Cohn, F.: Bacteria, the Smallest of Living Organisms (1872). Baltimore: Johns Hopkins University Press, 1939. Pp. 44. (Translation by C. Dolley, 1881; Introduction by M. C. Leikind.)

Dubos, R. J.: Pasteur, Free Lance of Science: Boston, Little, Brown & Co., 1950. Pp. 418.

Ford, W. W.: Bacteriology. New York: Paul B. Hoeber, Inc., 1939. Pp. 207.

Godlee, R. J.: Lord Lister. London: Macmillan, 1917. Pp. 676.

Henle, J.: On Miasmata and Contagia. Translated with an Introduction by G. Rosen. Baltimore: Johns Hopkins University Press, 1938.

Leikind, M. C.: The Discovery of Pathogenic Germs. Ciba Symposia 2:726-751, 1941.

Lister, J.: Collected Papers. London: Oxford, Clarendon Press, 1909. In 2 volumes.

New Books

BOOKS RECEIVED

The following books have been received by the Editor; they will be reviewed critically as space and facilities permit. Omission of more extended review, however is not to be taken as criticism of the merit of the book.

Basic Surgery. Edited by Leslie Oliver. Springfield, Ill.: Charles C Thomas, Publisher, 1959. Pp. 1,359, with 680 illustrations, including 4 color plates.

Orthopaedics: Principles and Their Application. By Samuel L. Turek. Philadelphia: The J. B. Lippincott Company, 1959. Pp. 906, with 600 illustrations.

The Surgeon's Tale: The Store of Modern Surgery. By Robert G. Richardson, New York: Charles Scribner's Sons, 1959. Pp. 278, with 45 illustrations.

History of American Medicine (MD International Symposia). Edited by Felix Marti-Ibanez. New York: MD Publications, 1959. Pp. 181.

Congenital Anomalies of the Hand and Their Surgical Treatment. By Arthur Joseph Barsky. Springfield, Ill.: Charles C Thomas, Publisher, 1958. Pp. 165, with 76 illustrations. *Reviewed in this issue.*

Surgery of the Stomach and Duodenum. By Claude E. Welch. Chicago: The Year Book Publishers, 1958. Pp. 405, with 83 illustrations by Muriel M. Miller. *Reviewed in this issue.*

Spinal Cord Compression. By I. M. Tarlov. Springfield, Ill.: Charles C Thomas, Publisher, 1957. Pp. 147, with 41 illustrations.

Le Diagnostic du Cancer d'Estomac a la Periode Utile (Diagnosis of Carcinoma of the Stomach at the Time Most Favorable for Treatment). By Rene A. Gutmann. Paris: G. Doin et Cie, 1956. Pp. 257.

Operative Surgery. Edited by Charles Rob and Rodney Smith. London: Butterworth & Co., Ltd.; Philadelphia, F. A. Davis Co., 1956. Vols. 1 and 2 of 8 (plus index). Profusely illustrated.

Pathology and Surgery of the Veins of the Lower Limbs. By Harold Dodd and Frank Cockett. Baltimore: The Williams & Wilkins Company, 1957. Pp. 462, illustrated.

Functional Bracing of the Upper Extremities. By Miles H. Anderson. Springfield, Ill.: Charles C Thomas, Publisher, 1958. Pp. 463. Illustrated.

The Handicapped. By Adolph A. Apton, M.D. New York: The Citadel Press, 1959. Pp. 124. *Reviewed in this issue.*

Injuries and Surgical Diseases of the Ischium. By Henry Milch. New York: Paul B. Hoeber, Inc., 1959. Pp. 163, with 106 illustrations. *Reviewed in this issue.*

That the Patient May Know. By Harry F. Dowling and Tom Jones, assisted by Virginia Samter. Philadelphia: W. B. Saunders Company, 1959. Illustrated. *Reviewed in this issue.*

The Clinical Management of Varicose Veins. By David Woolfolk Barrow. New York: Paul B. Hoeber, 1957. Pp. 167, with 70 illustrations.

Injuries and Surgical Diseases of the Ischium. By Henry Milch. New York: Paul B. Hoeber, Inc., 1959. Pp. 163, with 106 illustrations.

So far as this reviewer has been able to learn, this monograph is the first book to be devoted entirely to injuries and diseases of the ischium. Some of the illustrations are clearly reproduced, but others are blurred. The text itself is concisely written and clearly printed.

The author, Dr. Henry Milch, is Attending Orthopaedic Surgeon at the Hospital for Joint Diseases, New York City. He has written and published many articles about orthopedic problems and technics.

Milch points out in the preface of this book that pathologic processes in the ischium frequently produce symptoms in an area removed from this bone, leading to erroneous diagnoses of coxalgia or herniation of an intervertebral disc in the lumbar portion of the spine. Chapter 1 describes the anatomy of the sacrum; Chapter 2, physical and roentgen examination. The remaining chapters describe various diseases of and injuries to the ischium, together with their diagnoses and treatment, including osteochondritis, fracture, developmental or congenital deformities, osteitis of the ischium, pyogenic and tuberculous osteomyelitis, ischial bursitis and tumors. Surgical treatment of the ischium is also covered.

—EDWARD L. COMPERE, M.D.

That the Patient May Know. By Harry F. Dowling and Tom Jones, assisted by Virginia Samter. Philadelphia: W. B. Saunders Company, 1959. Illustrated.

The man who said "One picture is worth ten thousand words" was right, and the truth of his statement is well exemplified in the work of Tom Jones in making the illustrations for this text. For this is primarily a "picture book," although the text is supplied by an eminent author. The book, designed for the use of physicians in explaining medical situations to their patients, is beautifully put together. Diagrams in two and three colors illustrate the anatomic aspects of various diseases. The legends are clear and concise, in terms that the layman can readily understand.

Other text is at a minimum. Each section has a brief introduction explaining the problem at hand. The diagrams and legends tell the patient what he wants to know and what he should know about his particular ailment. There are 90 full-page sets of diagrams, and subject matter ranges from nutrition, metabolism and growth through infections, the respiratory tract, the cardiovascular system, the blood, the gastrointestinal system and abdomen, the genitourinary system, the musculoskeletal system, the nervous system and other miscellaneous topics.

The book is intended to aid the doctor or the nurse in putting the patient at ease, and is not, the authors warn, to be studied by the patient alone. The basic idea is that the patient will suffer less and cooperate more if he understands his situation. The volume is therefore a teaching tool, and the authors further recommend that the diagrams (complete with legends) be reproduced on lanterm slides or enlarged photographically for lecture purposes.

This is a book every practitioner—physician or surgeon—should own, and use daily.

—MAX THOREK, M.D.

Surgery of the Stomach and Duodenum. By Claude E. Welch. Chicago: The Year Book Publishers, 1958. Pp. 405, with 83 illustrations by Muriel M. Miller.

This is the third edition of this handbook of surgery of the stomach and duodenum. The previous editions have been augmented by additional sections on portal hypertension and the surgical treatment of its complications.

The contents are invaluable in their brief, succinct and thorough manner of step-by-step elucidation. The illustrations are excellently integrated with the text and are placed so

that the details of the steps of an operation and the numerous, more popular variations directly face each other, depicting every phase of the procedure.

The section on portal hypertension deals with various complications and surgical emergencies, such as bleeding from esophageal varices, ascites and acute gastrointestinal bleeding. The technic of portal systemic shunts is described, with integrated diagrams on the page opposite the text.

This excellent handbook should be among every doctor's *essential books*. The stomach and duodenum are studied, anatomically, historically, congenitally, surgically, pathologically, preoperatively and postoperatively, from every standpoint.

—JEROME J. MOSES, M.D.

The Handicapped. By Adolph A. Apton, M.D. New York: The Citadel Press, 1959. Pp. 124.

This concise book, written for the laity, represents a follow-up study of the last chapter of the author's previous work "Your Mind and Appearance: A Psychological Approach to Plastic Surgery" which is entitled "The Public versus the Malformed Person." Its aim is to acquaint people with the physical and psychological problems of the physically handicapped and to stimulate the nonhandicapped to accept the disabled person as a normal member of society.

After a short review of the history of the handicapped and of preventive medicine from ancient times to the present, the manifold difficulties of the disabled and their guidance from childhood to adulthood are discussed. An analysis of prejudice is followed by a description of education of the handicapped at home and at school. Vocational guidance and human relations are taken up in the last two chapters. Historical facts, quotations from the world literature and from national magazines and newspapers, and human interest stories are interspersed throughout the text. Physical handicaps of famous personalities of all times, as well as patients' case histories, are reported briefly to illustrate the fact that such hindrances can be overcome and need not be a deterrent to a useful, productive and happy life.

The little book is written in a fluent and instructive way, easily understandable to the layman. It not only makes for interesting reading but doubtless will serve its purpose fully. The author is to be commended highly for having handled the broad aspects of this timely and complex topic in an unusually impressive, factual and enlightening manner. Here is a splendid individual contribution to the unremitting efforts of United Nations' Specialized Agencies and of numerous international nongovernmental organizations toward the goal of complete rehabilitation of all handicapped persons. Education through information of young and old alike is a major prerequisite for achieving general equality for the disabled in our society and time. The widest possible circulation of this book among the public at large and those in social or professional contact with physically handicapped citizens appears essential and would be most welcome in the interest of public health.

—ERNEST G. ABRAHAM, M.D.

Congenital Anomalies of the Hand and Their Surgical Treatment. By Arthur Joseph Barsky. Springfield, Ill.: Charles C Thomas, Publisher, 1958. Pp. 165, with 76 illustrations.

The author of this compact monograph is an attending surgeon for plastic surgery, Mount Sinai Hospital, New York City, and Professor of Clinical Surgery, Albert Einstein College of Medicine, New York City. He holds many other hospital appointments. This small book includes a brief discussion of the causes of congenital anomalies, a chapter on the influence of heredity in transmitting these deformities from one generation to another, a discussion of embryology, and descriptions of the diagnosis and treatment of both simple and complex congenital deformities of the hand. All who may be called upon to diagnose and treat such deformities will want a copy of this book.

—EDWARD L. COMPERE, M.D.

An Atlas of Surgery. By F. Wilson Harlow. New York: Grune & Stratton, 1958. Pp. 363, with 1,292 illustrations.

Dr. Harlon has compiled an atlas as a visual aid in remembering the reasons underlying surgical practices. This work is intended as a supplement to standard texts. The format is interesting and utilitarian, in that photographs are correlated with line drawings and terse comments to depict a condition or procedure. For special commendation must be mentioned Section Two, *Urology*, and Section Three, *Gynaecology*. "An Atlas of Surgery" should prove a useful adjunct for students both of medicine and nursing and as a source of quick reference for ward nurses and "old grads" returning to help in this day of nursing shortages. This book can be recommended.

—P. THOREK, M.D.

Practical Blood Transfusion. By J. D. James. Springfield, Ill.: Charles C Thomas, Publisher, 1958. Illustrated. Pp. 187.

Dr. J. D. James is Director of the North London Transfusion Service, where, it is said, the standard of blood transfusion is the highest in the world. His unit is one of the largest centers of the National Transfusion Service, the latter reaching every part of England.

This text is therefore authoritatively written, from the author's own experience. It deals with all phases of the problem—the donor; the indications for transfusion; equipment and technics; treatment and reactions, and the hazards and legal aspects of transfusion. The recognized quality of his own service makes Dr. James' contribution invaluable, especially to hospital personnel. It goes without saying that every surgeon should be conversant with his work.

—M. T.

The Medical Secretary. By Kenneth B. Coffin and R. Forrest Colwell. New York: The Macmillan Company, 1959. Pp. 391.

One of the important "jobs behind the doctor" is that of his secretary, who is at the same time his business manager and his public relations representative. Her work is so specialized that many business schools have set up courses in medical stenography, office procedures, etc.

This text is really such a course, prepared for workers in the medical, hospital or dental office. A thorough analysis of each job situation is presented, with modern business procedures, work outlines and vocabulary drills. The unusual value of the book is in the presentation of the material in lesson form, with review questions and practice assignments. It can serve, therefore, as a classroom text or a "self-education" tool, invaluable in either circumstance.

—O. C.

Rapid shallow respiration denotes inflammation and pain in the vital parts; slow deep respiration indicates delirium or a seizure. Cold breath is a sign of death; so also is feverish and smoky breath, but less so than cold. Prolonged expiration and a small inspiration, short expiration and prolonged inspiration, are the worst kinds and nearest to death.

—*Hippocrates*

Abstracts from Current Literature

Hiatus Hernia: Its Incidence and Cinical Significance. Hafter, E., German Med. Monthly 3:1 (Jan.) 1958.

The radiologic aspects, the symptoms and the treatment of hiatus hernia are presented, on the basis of the observations in 300 cases. A characteristic triad of symptoms was noted: those localized to the retroxiphoid or epigastric region, those due to incompetence of the cardia and those due to secondary esophageal involvement. All these symptoms are dependent on posture; recumbency or an increase in intraabdominal pressure produces the symptoms, while an upright position results in their disappearance.

To obtain radiologic evidence of a hiatus hernia, the terminal portion of the esophagus should be filled with contrast medium, the patient being recumbent and exhaling, and entry of the hernia through the hiatus assisted by special positioning of the patient or by raising the intraabdominal pressure.

The incidence of hiatus hernia among the author's patients with upper abdominal symptoms was about 10 per cent, ranking third behind cholelithiasis (18 per cent) and duodenal ulcer (13 per cent).

In most cases the symptoms first appeared after the age of 50 years, but the diagnosis was often not made until several years later. In half of the cases hiatus hernia was associated with other diseases, most frequently cholelithiasis and gastrointestinal diverticulosis.

Treatment should be medical in most cases. It consists of instructing the patient to lie in a propped-up position at night and to avoid heavy evening meals, and of administering antacids, antispasmodics and sedatives.

The only indications for operation are hemorrhage, severe stenosing esophagitis and failure to respond to intensive conservative treatment in patients with very severe symptoms. The operative results are not always good and depend largely upon the skill of the surgeon and the technic used. The methods of Allison and Sweet are usually adopted. A restoration of the angle of His by esophagogastropexy appears to be particularly important to the successful result of the operation. The abdominal approach has been employed in recent years, especially for thin patients, as it seems to be less disturbing to them. No final opinion can be offered at this time on a simple technic of gastropexy to the anterior abdominal wall.

Of the author's 300 patients, 25 (8.3 per cent) underwent surgical treatment. The postoperative results in 19 patients operated upon by the thoracic approach were as follows: 8 patients were free of symptoms, 5 improved and 6 not improved. Of 6 patients operated upon by the abdominal route there were 5 free of symptoms and 1 not improved.

Other reports also show unsatisfactory postoperative results in between 25 and 35 per cent of the cases.

The diagnosis of hiatus hernia is still missed too frequently.

—ERNEST G. ABRAHAM, M.D.

Urinary Diversion with Bladder Substitution. Brunschwig, A., and Greenman, R. B., Surgery 45:240-250, 1959.

The authors review the several methods available for diversion of urine and the construction of a substitute for the bladder.

The various procedures will not be mentioned, since all surgeons are well acquainted with the advances made in this field over the past several years.

The conclusion of the authors is that no hard and fast recommendations can be made as to the choice of a procedure for bladder substitution. The choice depends on the surgeon's preference, the patient himself, his social status, the family's attitude, the problems to be faced after discharge and the availability of medical supervision.

SHEPARD JEROME, M.D.

Extramammary Paget's Disease. Grimes, O. F., Surgery 45:569, 1959.

Two cases are presented which lend support to the thesis that Paget's disease represents secondary malignant intracutaneous spread from underlying primary carcinoma. The primary tumors were adenocarcinoma of the anal canal, and special stains showed material in Paget's cells similar to that in the underlying carcinoma. It is probable that Paget's disease represents merely an unusual mode of spread to the skin along established lymphatic pathways.

EDMUND LISSACK, M.D.

The Source of Bleeding in Acute Subdural Hematoma. Klingler, M., and Schultheiss, H. R., German Med. M. 3:183 (June) 1958.

Intracranial hemorrhages following head trauma are classified as epidural, subdural and subarachnoid. Subdural hematomas may occur acutely in the first days following trauma, or chronically after a latent period of several weeks. In contradistinction to these two forms, the subarachnoid hemorrhages, which generally accompany cerebral contusions, are not accessible to surgical treatment.

The clinical symptoms of epidural and acute subdural hematomas are almost identical. Their chief characteristic is progressive, especially mental, deterioration. Since the mental symptoms are more common and reliable than the neurologic manifestations, such as progressive hemiparesis and unilateral pupillary dilation, each patient with progressive loss of consciousness following an accident should be suspected of having a hematoma.

The source of the bleeding varies with the three types. Epidural hematoma is usually the result of an injury to the middle meningeal artery. The chronic subdural hematoma seems to originate most commonly from the veins that bridge the subdural space from the cerebral cortex to the sagittal sinus. The acute form, however, occurs in cases of severe injury to the skull with extensive cerebral contusion. Generally it is localized more laterally than is the chronic subdural form and does not extend to the superior sagittal sinus.

Four cases are reported. In those with severe head trauma and cerebral contusions leptomeningeal vessels were torn in addition to the arachnoid. In cases without severe damage to the brain tissue a punctate defect in a leptomeningeal vessel occurred, probably as a result of sudden impact against the calvarium.

It is concluded that no single source of bleeding exists which is common to all acute subdural hematomas. Moreover, the site of origin occasionally cannot be found.

ERNEST G. ABRAHAM, M.D.

Conservatism in Obstetrics. Stallworthy, J., Northwest Med. 57:867, 1958.

Conservatism in obstetrics is instinctively contrasted with what one imagines to be the radical approach. One man, having assessed the problem of a high head at term in a primigravida, says "Nature can deal with this," while a colleague, reviewing the same problem, decides that the knife and not nature must prevail. The one is considered conservative, the other radical; but to accept this classification without knowing what happened to the patient would be to oversimplify the position. Generally speaking, one cannot with justice label a man radical or conservative by his handling of isolated selected cases for which one has had no clinical responsibility. It is easy to be wise and infallible when the final decision is not one's own. The general pattern of a man's practice is found only in a comprehensive survey of his work.

The subject of conservatism in obstetrics is wide, but the selected examples given in this study, and the lessons learned from them, must suffice. In the last fifty years technics have changed, often dramatically, to the great advantage of mother and baby. Neither the conservative nor the radical attitude has consistently yielded rich dividends, but each in its time and place has contributed to progress. Contrary to what is often said and written, obstetrics can still be an art for those who wish to practice it as such. General principles can be a guide, but in art there is infinite opportunity for self-expression linked with a constant striving for perfection. When this desire is nurtured, we need not fear the future.

EDMUND LISSACK, M.D.

Experiences with the Surgical Treatment of Aneurysms of the Abdominal Aorta. Mahaffey, J. H., J. of Kentucky State M. A. 56:1103, 1958.

Nonruptured Abdominal Aortic Aneurysms.—Briefly, the surgical technic used is described. The aneurysm is resected, and continuity of flow is reestablished by the insertion of a bifurcated abdominal aortic homograft or a suitable vascular prosthesis. A long midline incision extending from the xiphoid process down to the symphysis pubis is employed. The small intestine is eviscerated onto the right side of the abdomen and covered with warm moist packs. The posterior peritoneum overlying the aneurysm is incised to the left of the root of the mesentery of the small intestine, as in the ligament of Treitz. The inferior mesenteric artery is divided at its point of origin. The aorta proximal to the aneurysm is mobilized by blunt dissection and encircled with umbilical tapes, after which distal control of the iliac vessels is obtained. Ten mg. of heparin solution in saline is injected into the aneurysm, and vascular clamps are applied proximal and then distal to the aneurysm.

The aneurysm is excised from below upward, with division of the lumbar vessels, which subsequently are ligated. Depending on the ease with which they may be approached, occasionally some of the lumbar arteries are ligated and divided prior to occlusion of the aorta. Continuity of flow is restored by the insertion of a reconstituted freeze-dried aortic homograft or a vascular prosthesis that has been soaked in some of the patient's blood to pre-clot, thus minimizing leakage through the graft.

The proximal anastomosis is carried out with a continuous through-and-through suture, begun posteriorly, of No. 000 intestinal silk. The distal anastomosis is completed in a similar fashion with No. 0000 arterial silk. After completion of one iliac anastomosis the opposite iliac portion of the graft is clamped, and circulation is reestablished on the completed side, thus minimizing the duration of occlusion on that side.

After satisfactory restoration of flow, the posterior peritoneum and the ligament of Treitz are approximated. In the last few cases, because of the ileus commonly associated with the procedure, a gastrostomy has been done, with use of a Foley catheter with a 30 cc. bag. This obviates the need of a Levine tube, necessary for four or five days, with its attending discomfort, impairment of the cough reflex, and increase in the incidence of respiratory complications. The abdominal incision is closed in layers, as well as with retention sutures of No. 5 silk placed through all layers except the peritoneum.

The period of total aortic occlusion in this group varied from sixty-eight to one hundred and five minutes, with an average of eighty-seven minutes.

Every patient survived elective resection of the aneurysm and is in excellent condition as far as the operation is concerned.

Ruptured Abdominal Aortic Aneurysms.—Prompt and early surgical intervention, resection of the ruptured aneurysm and restoration of continuity of flow with an aortic homograft or a suitable vascular prosthesis can convert a hopeless prognosis into a relatively more favorable one.

WILLIAM E. NORTH, M.D.

Fistules Biliaires Internes Spontanees d'origine Lithiasique (Spontaneous Internal Biliary Fistulas Secondary to Cholelithiasis). Kourias, B. and Tsoufis, E., J. de chir. 75: 353, 1958.

The authors review 65 cases of internal biliary fistula operated upon in the surgical clinic of the Greek Red Cross Hospital between 1937 and 1957. In 21 cases (0.7 per cent) the fistula was secondary to duodenal ulcer and in 44 cases to cholelithiasis. Of the latter, 32 were biliodigestive and 7 biliobiliary fistulas.

This study was mainly concerned with fistulas secondary to cholelithiasis. Roentgen studies were helpful in making the diagnosis in 20 to 30 per cent of the cases. When the fistulas were secondary to a duodenal ulcer the common bile duct was visualized first in most of the cases, when secondary to cholelithiasis, the gallbladder filled first.

Surgical treatment of the biliodigestive fistulas was based on closure of the fistulous con-

nection with the gastrointestinal tract. The operations performed for these fistulas consisted of cholecystectomy, choledochostomy and choledochoduodenostomy, as well as hepaticojejunostomy with a Roux en Y anostomosis. The mortality rate, 12.5 per cent, was rather high, owing to the poor condition of the patients who suffered often from recurrent cholangitis and hepatic cirrhosis.

As to the biliobiliary fistulas, they were encountered in 7 cases. Roentgen studies, including preoperative cholangiograms, were not very helpful. It was only by careful surgical technic that the fistulous tract was visualized.

The authors advocate use of the antegrade method of resection of the gallbladder, as well as the endovesicular route of examination of the biliary tree to prevent injury thereto. When there is a large fistula, with loss of substance of some of the hepatic or common bile ducts, they advise using part of the wall of the gallbladder for closure of the defect.

S. ATTAR, M.D.

Congenital Choledochal Cyst, with a Report of 2 and an Analysis of 94 Cases. Alonzo-Lej, F., Rever, W. B. Jr., and Pessagno, D. J., Internat. Abst. Surg. 108:1, 1959.

Four hundred and three authentic and 16 doubtful cases of congenital choledochal cyst are collected from the world literature. Ninety-four are newly analyzed, and 2 new cases are reported.

The disease is congenital. The cause is a weakness in a specific portion of the common bile duct, caused by hyperproliferation and hypervacuolization of that area during embryonic development. Such a weakness constitutes a protodilatation status, which develops into the clinical pathologic entity when the ductal pressure increases because of an obstructive factor.

A classification is presented, showing three types: cystic dilatation, diverticulum and choledochocele.

Pain, jaundice and mass are the classic diagnostic triad. Intermittence of these symptoms increases the probability of congenital cystic dilatation. Jaundice is absent in the diverticular type. In the presence of choledochocele a mass is absent, but nausea or vomiting is always present.

The Japanese race and the female sex seem to be affected particularly. Eighty-two per cent of the patients in this study were under 30 years of age.

Differential Diagnosis.—Conditions to be considered are as follows: hydatid cyst; cholelithiasis; congenital atresia; congenital cysts of the liver; Wilms tumor and other retroperitoneal neoplasms; carcinoma; sarcoma; carcinoma of the ampulla of Vater or head of the pancreas, and pancreatic cyst.

Removal of the cyst with anastomosis of the remaining biliary tree to the duodenum or jejunum is the authors' treatment of choice. Choledochocystojejunostomy has low mortality and morbidity rates and is considered an adequate procedure. Choledochocystoduodenostomy has a higher morbidity rate.

Each succeeding review of the literature shows a significant increase in the number of cases reported and in the number of accurate preoperative diagnoses. There has been, also, a decrease in the operative mortality rate and a tendency toward removal of the choledochal cyst as the treatment of choice.

WILLIAM E. NORTH, M.D.

Carcinoma of the Endometrium. Pentecost, M. P. Jr., and Brack, C. B., Southern M. J. 52:190, 1959.

This article describes a series of 115 patients with adenocarcinoma of the endometrium, treated at the Johns Hopkins Hospital between 1940 and 1950 inclusive.

Patients who were good operative risks were treated with intracavity radium irradiation followed by conservative total hysterectomy, and poor risks by irradiation alone. A small group of patients was treated by conservative hysterectomy alone.

The five-year salvage rate is 63.8 per cent in the group treated with irradiation and hysterectomy; 61.5 per cent in the group treated by hysterectomy only, and 32.3 per cent in those treated by irradiation only.

When the carcinoma is completely eradi-

cated by preoperative radium irradiation, the salvage rate is 79.2 per cent as compared to 50 per cent when persistent tumor is present in the operative specimen.

EDMUND LISSACK, M.D.

Total Bilateral Polyvinyl Ureteral Substitutes in the Dog. Ulm, A. H., and Lo, M. C., Surgery 45:313-319, 1959.

Many ureteral substitutes have been tried in the past. Some of these have been viable and nonviable veins, arteries, fascia, rolled bladder wall, skin tubes and ileum, and prostheses, such as vitallium, tantalum and polyethylene.

The inert materials have been unsuccessful, owing to migration of the prosthesis and encrustation by urinary salts.

These authors have experimented on 10 dogs, using polymerized polyvinyl tubing as the substitute ureter.

Their results show that, in the dog, a motile conduit is not needed between kidney and bladder. Three dogs lived more than one year, and their pyelograms showed no renal damage. Encrustation occurred in only 1 animal. The flanging technic in the placement of the tube prevented its migration.

The authors conclude that this technic is suitable for dogs, but the material used is unsuitable for use in man.

SHEPARD JEROME, M.D.

Intra-aortic Nitrogen Mustard Therapy in Advanced Pelvic Malignancy. Byron, R. L. Jr., Singh, B. P., Bierman, H. R., and Kelly, K. H., Surgery 45:634, 1959.

Thirty-four patients with hopelessly incurable pelvic malignant disease were treated with intra-aortic HN_2 in doses ranging from 0.2 to 1.6 mg. per kilogram of body weight. Of this series, 31 were subjected to an exploratory laparotomy and intra-aortic administration of the drug, with venous occlusion at the time of operation. The remaining 3 patients were treated by administration of the drug through an indwelling intra-aortic catheter.

Seven patients showed objective improvement. There were 3 postoperative deaths.

In the authors' hands, arterial HN_2 therapy proved to have some significance in the palliation of advanced pelvic malignant disease. They believe that patients who have malignant tumors that are localized to the pelvis and are not amenable to operation or irradiation are suitable for intra-aortic nitrogen mustard therapy.

EDMUND LISSACK, M.D.

It has been established repeatedly by subsequent laparotomy that a gastric or duodenal ulcer, treated medically before it has reached the stage of a fibrous lesion involving all the coats, may heal without leaving a scar visible to the naked eye. Even a larger and more chronic ulcer may heal, and remain healed if the social economic and dietetic factors that caused it can be eliminated. Such a result is infinitely better than that achieved by surgical treatment, good though this may be, for all operations designed to remove the ulcer and its cause imply a profound and permanent recasting of the mechanism of digestion. In dealing with a peptic ulcer which has no features suggesting malignancy, the surgeon should emulate the infinite capacity for postponement of the Arab or the South American peasant.

—Ogilvie

IMPORTANT ANNOUNCEMENT

Contributors of scientific articles for publication in The Journal of the International College of Surgeons from Europe, the Near East and the Middle East should send their articles to:

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6-8 Rue de la Confederation
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A special committee has been appointed to evaluate the papers submitted for publication. The Journal publishes summaries in English, French, German, Spanish, Italian and Portuguese. Summaries of articles should be included in as many of these languages as possible.

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Les auteurs d'articles scientifiques destinés à être publiés dans le Journal du Collège international de chirurgiens sont priés d'adresser leurs artieles à l'adresse suivante pour l'Europe, le Proche et le Moyen Orient.

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Un comité a été nommé pour l'examen des articles à paraître. Les auteurs sont priés de joindre à leur travail de brefs résumés en français, anglais, allemand, espagnol, italien et portugais si possible.

The following pages comprise

Section II

the BULLETIN

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FOUNDED BY DR. MAX THOREK

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